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INTRODUCTION

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IAA is available on subscription from the American Institute of Aeronautics and Astronautics, Technical Information Service, 750 Third Avenue, New York, New York 10017, at the following annual rates:

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Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **2365**

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Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. **2370**

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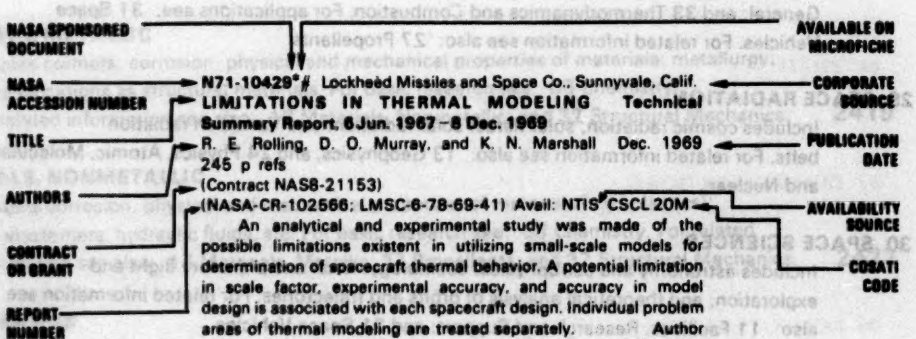
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N71-10429*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
LIMITATIONS IN THERMAL MODELING Technical Summary Report, 6 Jun. 1967 - 8 Dec. 1969
R. E. Rolling, D. O. Murray, and K. N. Marshall Dec. 1969
245 p refs
(Contract NAS8-21153)
(NASA-CR-102566; LMSC-6-78-69-41) Avail: NTIS CSCL 20M
An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author

VOLUME 9 NUMBER 15 / AUGUST 8, 1971

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

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Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N71-26920# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

A WIND TUNNEL INVESTIGATION OF THE FORCES ACTING ON AN EJECTOR IN FLIGHT Final Report

Brian Quinn Dec. 1970 97 p refs

(AD-721192; ARL-70-0141) Avail: NTIS CSCL 20/4

The lift and drag forces experienced by an ejector in a wind tunnel were measured and correlated with the geometry and static performance of the device. Lift forces in excess of three times the total static thrust are readily obtained at moderate tunnel speeds and with very little penalty in increased drag. Whereas the primary mass flowing to the ejector remained constant, pressure surveys at the exit plane of the ejector indicated a reduction in total pressure with increasing tunnel speed. Author (GRA)

N71-26950*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EXCITATION OF BOUNDARY-LAYER TURBULENCE THROUGH SPARK DISCHARGES

Enrique J. Klein Washington May 1971 20 p refs

(NASA-TN-D-6378; A-3673) Avail: NTIS CSCL 04D

An experimental investigation was made of the effect of spark discharges into a laminar boundary layer at supersonic free stream Mach numbers. Flow visualization studies showed that a spark could generate a boundary layer disturbance with a turbulent structure that grows as it is swept downstream. Local skin friction was measured by a floating element balance installed in a flat plate model downstream of a pair of electrodes embedded flush with the surface near the sharp leading edge. Tests were carried out in the Ames 1 by 3 foot supersonic wind tunnel at Mach numbers of 1.98, 2.56, 3.53 and 3.88, using spark discharge frequencies from 0 to 32,000 sparks per second. The local skin friction coefficient c sub f could be brought to a turbulent level in normally laminar and transitional boundary layer regions with the higher spark discharge frequencies. The resulting level of c sub f was comparable to that obtained with spherical trips, or with normal turbulence, or from theory. The measured skin friction was found to be significantly affected by the spark discharge frequency, but little affected by changes in the energy per spark. The kinetic and thermal energy into the medium from a single spark was computed from experimental data by means of an available numerical solution. This energy was of the order of 1 percent of the electrical input to the spark. Author

N71-26988*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EXPERIMENTAL INVESTIGATION OF A LARGE SCALE, TWO-DIMENSIONAL, MIXED COMPRESSION INLET SYSTEM: PERFORMANCE AT SUPERSONIC CONDITIONS, M = 1.55 TO 3.2

Norman D. Wong and Warren E. Anderson Washington Jun. 1971 62 p refs

(NASA-TN-D-6392; A-3770) Avail: NTIS CSCL 04D

A large-scale, variable-geometry inlet model with a design Mach number of 3.0 was tested at Mach numbers from 1.55 to 3.2. Variable features of the inlet for off-design operation are an adjustable-height ramp system and a translating cowl. Experimental results for a diffuser and boundary-layer bleed configuration which was optimized at the design Mach number are presented. Overall performance was high with throat-mounted vortex generators, which were effective in reducing flow distortion in the subsonic diffuser at the higher Mach numbers. Author

N71-27003*# Lockheed-Georgia Co., Marietta.

THE CALCULATION OF THREE DIMENSIONAL TURBULENT BOUNDARY LAYERS ON HELICOPTER ROTORS

J. G. Hicks and J. F. Nash Washington NASA May 1971 67 p refs

(Contract NAS2-5652)

(NASA-CR-1845) Avail: NTIS CSCL 01B

The three-dimensional turbulent boundary layer on a helicopter rotor was investigated analytically. The method of Nash, which takes into account crossflows and crossflow derivatives, was modified to include the effects of centrifugal and Coriolis forces. The technique was quasi-steady in the sense that the blade was assumed to be frozen at any given azimuthal position. Calculations were performed on an NACA 0012 section and an advanced airfoil for a range of azimuthal positions and two advance ratios. Cases were also run in which spanwise derivatives, and spanwise velocities and derivatives were neglected, corresponding to flows over infinite yawed wings and to two-dimensional flows, respectively. For cases where the rotor was at high incidence, the calculation method predicted early separation. Investigations of this condition led to the conclusion that the omission of the effects of time-dependence was probably responsible for the pessimistic estimates of the separation boundaries. Author

N71-27004*# Massachusetts Inst. of Tech., Cambridge. Gas Turbine Lab.

COMPUTATIONAL STUDIES OF THREE-DIMENSIONAL TRANSONIC SHEAR FLOW: WORK IN PROGRESS

David A. Oliver and Panagiotis Sparis Washington NASA May 1971 38 p refs

(Grant NGL-22-009-383)

(NASA-CR-1816; GTL-101) Avail: NTIS CSCL 20D

The structure of three-dimensional transonic shear flow in a turbomachine cascade is examined in the context of a time

dependent computer experiment. A transonic inlet Mach number profile along the span of the blade is incident on the cascade. This profile leads to the development of shocks located at the blade tip which weaken along the span of the blade and merge with the sonic surface. The static pressure rise across these tip shocks is effectively communicated across the passage to the hub end where it results in a deceleration of the hub flow which remains totally subsonic. The inlet stagnation pressure profile is manifested as a static pressure gradient at the blade leading edge which then induces strong cross flows along the span. The flow at the supersonic portion of the blade, however, expands to a much lower pressure than the pressure at the subsonic hub and so that this cross flow eventually reverses back towards the tip near the trailing edge.
Author

N71-27028*# Wyle Labs., Inc., Huntsville, Ala.
ANALYTICAL PROPERTIES OF NOISE GENERATING MECHANISMS IN A SUPERSONIC JET EXHAUST FLOW
S. P. Pao Washington NASA May 1971 62 p refs
(Contract NAS8-25893)
(NASA-CR-1848; WR-71-6) Avail: NTIS CSCL 20D

Explicit analytic expressions for studying noise generating mechanisms and detailed formulas for numerical computations were derived, following the generalized supersonic turbulent jet noise theory. In a supersonic jet, both the shear noise and the self noise sources remain equally effective. For both types of sources, there are three principal modes of sound radiation, two Mach modes (S.1) and (S.2), which follow the U(3) law, and a pure acoustic mode, (S.0), which follows the U(8) sequence set ((1-M cos theta)sq + alpha sq M sq) to the minus 2.5 power dependence. These solutions are markedly different in their analytical structure. The transition between the U(8) law and the U(3) law, acoustic efficiency for all Mach numbers, source distribution, and the coupled effect of refraction and Doppler shift are discussed in detail. Some preliminary results of noise directivity and spectrum are also given.
Author

N71-27149# National Physical Lab., Teddington (England). Aerodynamics Div.
ON THE STATIC PERFORMANCE OF TWO-DIMENSIONAL INTAKES WITH MOMENTUM INJECTION IN THE FORM OF BOUNDARY-LAYER CONTROL BY BLOWING
N. Gregory London Aeron. Res. Council 1971 59 p refs Supersedes NPL-AERO-SR-006; ARC-29888
(ARC-R/M-3656; NPL-AERO-SR-006; ARC-29888) Copyright. Avail: NTIS; HMSO: £1.50; BIS: $5.40

An incompressible design method is given for calculating intakes in which the lip is a constant-pressure surface at zero forward speed. Static performance is examined by a onedimensional theory and two reasons for separation distinguished. When separation is reduced in extent or prevented by blowing, experiments showed maximum increases of 2% in efficiency of total pressure recovery, without optimization of slot width or intake shape. In other cases, the effect of blowing on performance is in theory small, and in practice adverse.
Author (ESRO)

N71-27150# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
EXPERIMENTAL STUDY OF THE ACTION OF VORTICES ON CYLINDERS WITH LONGITUDINALLY WELDED BLADES [ETUDE EXPERIMENTALE DE L'ACTION DES TOURBILLONS SUR DES CYLINDRES MUNIS D'AILETTES SOUDEES LONGITUDINALEMENT]
Mariette Alexandre (Cockerill S. A.) Brussels Centre de Rech. Sci. et Tech. de L'Ind. des Fabric. Metal. Jan. 1971 24 p In FRENCH Sponsored by IRSIA Prepared jointly with Liege Univ.
(CRIF-MT-69) Copyright. Avail: NTIS

Results of wind tunnel tests on wind induced vibrations of chimnies are presented. The vibration damping effect of vertical fins at different positions are discussed and the ratio of amplitude of finned tube to original pulse and aerodynamic drag are analyzed
ESRO

N71-27613# Sandia Corp., Livermore, Calif. Advanced Development Div.
SIXD: A TRAJECTORY COMPUTER PROGRAM TO DETERMINE THE MOTIONS OF ASYMMETRIC MISSILES
J. K. Kryvoruka Feb. 1971 50 p refs
(SCL-RR-70-121) Avail: NTIS

A formlation of the equations of motion for a generally asymmetric, rigid body is presented. Consistent with this development, a trajectory computer program (SIXD) for numerical solution of the six rigid-body degrees of freedom on a large-scale digital computer is described. The major features of the program include an Adams-Moulton predictor-corrector integration scheme, a unimodular quaternion angular substitution, and an extensive capability for aerodynamic input with particular emphesis on the various nonlinear-induced effects associated with finned bodies. In addition, a detailed description of program input and output is given.
Author

N71-27616# Technische Hochschule Aachen (West Germany). Inst. fuer Allegemein Mechanik.
EXPERIMENTAL DETERMINATION OF THE AERODYNAMIC HEAT OF SPACE FLIGHT BODIES IN THE HYPERSONIC RANGE WITH ADDITIONAL FORCE AND PRESSURE MEASUREMENTS [EXPERIMENTELLE BESTIMMUNG DER AERODYNAMISCHEN ERWAERMUNG VON RAUMFLUGKOERPERN IM HYPERSCHALLBEREICH MIT ZUSAETZLICHER KRAFT- UND DRUCKMESSUNG]
K. Finke and H. Groenig Bad Godesberg, West. Ger. Bundesmin. fuer Bildung und Wiss. Feb. 1971 59 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-71-08) Avail: NTIS; ZLDI Munich: 12.50 DM

In a hypersonic shock tunnel heat transfer measurements at laminar boundary layer conditions were performed on both a thick 70 deg delta wing with a blunt nose and cylindrical leading edges and on a blunt elliptic half cone. The experimental data investigated at 5.3 and 8.1 Mach numbers, 0, 20, and 40 deg angles of attack, and Reynolds numbers from 13,500 to 57,000 based on a model length of 0.15 m were compared with various theories. The development of a data recording and processing equipment is described. The equipment consists of an analog magnetic tape recorder and an analog to digital converter. For force and moment measurements in the hypersonic shock tunnel a 3- and 6-component balance system has been developed.
Author (ESRO)

N71-27673*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BLOWN FLAP NOISE RESEARCH
R. G. Dorsch, E. A. Krejsa, and W. A. Olsen 1971 19 p refs Presented at the Seventh Propulsion Joint Specialist Conf., Salt Lake City, 14–18 Jun. 1971; sponsored by the Am. Inst. of Aeron. and Astronaut. and the Soc. of Automotive Engr.
(NASA-TM-X-67850; E-6355) Avail: NTIS CSCL 01A

Noise data were obtained with models of both internally and externally blown jet-flaps of the type currently being developed for STOL aircraft. The principal tests were conducted with an augmentor-wing model and with an externally-blown double-slotted-flap model. Secondary tests were conducted with a jet flap model. The interaction between the jet and the flap assembly caused both redirection and generation of noise. The data were extrapolated to representative full scale STOL airplane flap systems. It is shown that with a quiet engine the blown flap noise can be the major contribution to the total aircraft noise. Suppression techniques are proposed.
Author

N71-27674# Sandia Corp., Albuquerque, N.Mex.
FLAP EFFICIENCY AT HYPERSONIC SPEEDS. THEORETICAL AND EXPERIMENTAL FLAP INVESTIGATION [ETUDE THEORIQUE ET EXPERIMENTALE DE L'EFFICACITE DE GOUVERNES EN HYPERSONIQUE]
Rene Caresuela et al 8 Mar. 1971 49 p refs Transl. into ENGLISH from Aeronaut. Astronaut. (Paris), no. 18, 1970 p 15–28
(SC-T-71-3016; ONERA-TP-814) Avail: NTIS

The heating rate and efficiency of a flap are governed at hypersonic speeds by the compression process of the thick turbulent boundary layer on it. The theoretical investigation of such compression raises two approaches. One is the integration of the boundary layer equations, coupled with equations for the external flow, and the other describes, by the method of characteristics, the boundary layer as a rotational inviscid flow. The computed values are compared with test results obtained at Mach 10, at Reynolds numbers of over 20 × 10 to the 6th power. The method of characteristics yields findings that check remarkably well with the compressions measured on deflected flaps; the resulting flap efficiencies are reduced by 30% as compared to those predicted from a simple oblique shock computation. Author

N71-27707*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WIND TUNNEL TESTS OF A WING INSTALLED MODEL VTOL LIFT FAN WITH COAXIAL DRIVE TURBINE
S. Lieblein, J. A. Yuska, and J. H. Diedrich 1971 38 p Presented at the Seventh Propulsion Joint Specialists Conf., Salt Lake City, 14–18 Jun. 1971; sponsored by the Am. Inst. of Aeron. and Astronaut.
(NASA-TM-X-67854; E-6359) Avail: NTIS CSCL 01A

A summary is presented of principal results obtained from crossflow tests of a 15-in. diameter lift fan installed in a wing in a 9 by 15 ft V/STOL wind tunnel. The basic objective was to determine lift fan behavior in the cross flow environment and to define the principal factors affecting fan performance. The fan stage was designed for a pressure ratio of 1.28 at a corrected tip speed of 980 ft/sec. The unique feature of the fan is a compact drive turbine coaxially mounted within the hub section of the fan which provided for coaxial exhaust streams. Tests were run with and without exit louvers over a wide range of tunnel air speeds, fan speeds, and wing angle of attack. The results presented provide a comparatively complete picture of the basic features of the internal flow in a lift fan in crossflow. Back pressure effects in influencing fan performance are discussed. In this particular fan, flow separation on the inlet bellmouth did not appear to be a serious problem for crossflow operation. Author

N71-27714# National Physical Lab., Teddington (England). Aerodynamics Div.
EXPERIMENTAL VERIFICATION OF PREDICTED STATIC HOLE SIZE EFFECTS ON A MODEL WITH LARGE STREAMWISE PRESSURE GRADIENTS
P. G. Pugh, J. W. Peto, and L. C. Ward London Aeron. Res. Council 1971 19 p refs Supersedes NPL-AERO-1313; ARC-31900
(ARC-CP-1139; NPL-AERO-1313; ARC-31900) Copyright. Avail: NTIS; HMSO: 25p; BIS: $1.00

Data obtained during the measurement of surface pressures on a spherically-blunted cone are used to demonstrate the value of a simple method by which allowance is made for the effects of finite static hole size on the measured distribution of pressure over the spherical portion of the model. Author (ESRO)

N71-27715# National Physical Lab., Teddington (England). Aerodynamics Div.
SUBSONIC THEORETICAL LIFT-CURVE SLOPE, AERODYNAMIC CENTRE AND SPANWISE LOADING FOR ARBITRARY ASPECT RATIO, TAPER RATIO AND SWEEPBACK
H. C. Garner and Sandra M. Inch London Aeron. Res. Council 1971 49 p refs Supersedes NPL-AERO-1317; ARC-32143
(ARC-CP-1137; NPL-AERO-1317; ARC-32143) Copyright. Avail: NTIS; HMSO: 65p; BIS: $2.60

Solutions by lifting-surface theory are tabulated for 64 planforms with systematic variation in aspect ratio, taper ratio, and sweepback. The accuracy of existing data sheets is examined. With the aid of sonic theory and the usual similarity rules, alternative graphical presentations of the new data are discussed. A simple relationship between trailing-vortex drag and spanwise center of pressure is accurate to about 1%. Author (ESRO)

N71-27716# National Physical Lab., Teddington (England). Aerodynamics Dept.
SOME OBSERVATIONS ON VORTEX SHEDDING AND ACOUSTIC RESONANCES
M. Gaster London Aeron. Res. Council 1971 16 p refs Supersedes NPL-AERO-1311; ARC-31829
(ARC-CP-1141; NPL-AERO-1311; ARC-31829) Copyright. Avail: NTIS; HMSO: 25p; BIS: $1.00

Studies on vortex shedding from cylinders and plates show that very powerful resonances can be produced, but that these are determined by the dimensions of the wind tunnel. Author (ESRO)

N71-27717# National Physical Lab., Teddington (England). Aerodynamics Dept.
A NUMERICAL PROCEDURE FOR CONSTRUCTING SHOCK-WAVE ENVELOPES AROUND CONICAL BODIES USING DATA FROM SCHLIEREN PHOTOGRAPHS
M. J. Larcombe London Aeron. Res. Council 1971 16 p refs Supersedes NPL-AERO-1092; ARC-32299
(ARC-CP-1143; NPL-AERO-1092; ARC-32299) Copyright. Avail: NTIS; HMSO: 25p; BIS: $1.00

The cross-section shape of shock waves surrounding conical bodies can be determined by schlieren photography from measurements of the tangent planes of the shock wave. A numerical procedure has been devised to provide a mathematical function describing the shape of the shock wave utilizing the tangent plane data and thus reducing the amount of time spent in graphical constructions as well as providing data for further analysis. Author (ESRO)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N71-26804# Radio Technical Commission for Aeronautics, Washington, D.C.
A NEW GUIDANCE SYSTEM FOR APPROACH AND LANDING. VOLUME 1
18 Dec. 1970 80 p
(DO-148-Vol-1) Avail: NTIS; RTCA Secretariat, Suite 655, 1717 H St., N.W., Washington, D.C. 20006 $10.00

Recommendations for a new microwave scanning landing guidance system (LGS) are presented. The recommendations are based on the results of a three-year effort involving the distillation of operational and technical requirements, current and prospective technology, and system and economic analyses. The proposed system, encompassing a major single concept with two end branches,

is a highly flexible building block system designed to meet the needs of minimum-requirement general aviation users on the one hand, and full-scale all-weather automatic landing and multiple closely spaced runway environments on the other. The recommended LGS provides for guidance information that may be expected to have a high order of integrity, both in terms of accuracy and reliability of the information transmitted and detected. A complete description of the system is given along with the specific technical characteristics of the provisional signal format with its two branches. A summary of operational requirements, and recommendations for follow-on actions are included. D.L.G.

N71-26895# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AIRBORNE SEARCHLIGHTS Final Report
26 Feb. 1971 19 p refs
(AD-721155; MTP-7-3-064) Avail: NTIS CSCL 1/3

Procedures are specified for evaluating the effectiveness of visible and infrared searchlights mounted on fixed and rotary wing aircraft during tactical support army missions. Author (GRA)

N71-27002*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FLIGHT DETERMINED ACCELERATION AND CLIMB PERFORMANCE OF AN F-104G AIRPLANE FOR USE IN AN OPTIMUM FLIGHT PATH COMPUTER PROGRAM
Robert T. Marshall Washington Jun. 1971 37 p refs
(NASA-TN-D-6398; H-636) Avail: NTIS CSCL 01B

A flight-test investigation was conducted to determine the standard-day performance characteristics (excess thrust, fuel flow, and climb potential) at maximum afterburner power for an F-104G airplane. The tests were conducted at Mach numbers from 0.5 to 2.0 and at altitudes from 5000 feet (1524 meters) to 50,000 feet (15,240 meters). The standard-day excess thrust and fuel-flow data obtained from the investigation were used to define a computer model of the performance of the test airplane. In addition, the climb-potential (specific excess power) data obtained from the flight tests were compared with the available predicted climb-potential data. From the comparisons, it was found that the predicted data for the average F-104G airplane did not represent the performance of the test airplane as accurately as required for the computation of meaningful flight trajectories. Therefore, to compute meaningful flight trajectories for the test airplane, the flight-derived model should be used. Author

N71-27009*# Little (Arthur D.), Inc., Cambridge, Mass.
INSTITUTIONAL FACTORS IN CIVIL AVIATION: JOINT DOT-NASA CIVIL AVIATION RESEARCH AND DEVELOPMENT POLICY STUDY Final Report, Jul.–Nov. 1970
Robert C. Fraser Jan. 1971 211 p refs Prepared in part by Simat, Helliesen and Eichner, Inc. for DOT and NASA
(Contract DOT-OS-00083)
(NASA-CR-1807; DOT-TST-10-1) Avail: NTIS CSCL 01B

Institutional factors which are constraining the civil aviation R and D process by which new or improved systems and equipment are developed in response to civil aviation needs are identified. Options to remove or attenuate the constraints are postulated and the advantages and disadvantages of choosing any given option in order to help guide national policy-makers are discussed. Author

N71-27010*# Booz-Allen Applied Research, Inc., Bethesda, Md.
A HISTORICAL STUDY OF THE BENEFITS DERIVED FROM THE APPLICATION OF TECHNICAL ADVANCE TO CIVIL AVIATION. VOLUME 1: SUMMARY REPORT AND APPENDIX A (DETAILED CASE STUDIES): JOINT DOT-NASA CIVIL AVIATION RESEARCH AND DEVELOPMENT POLICY STUDY
Feb. 1971 176 p refs
(Contract DOT-OS-00020)
(NASA-CR-1808; DOT-TST-10-2-Vol-1) Avail: NTIS CSCL 01B

The benefits to the nation resulting from the application of technical advances to civil aviation are determined. The technical advances that occurred since 1945 and the funds expended on aeronautical R and D are identified. The applications of the advances to civil aircraft and flight related systems are determined. Criteria for determining the benefits of civil aviation are established and quantified where possible. A general methodology for relating the advances and the benefits was developed through the impact of technical advances on the performance of the aircraft and flight related systems. Specific methods were used to relate each benefit criterion to advances. These methods were applied to form detailed case studies and, as a result, some modifications to the methods are proposed. Author

N71-27011*# Booz-Allen Applied Research, Inc., Bethesda, Md.
A HISTORICAL STUDY OF THE BENEFITS DERIVED FROM APPLICATION OF TECHNICAL ADVANCES TO CIVIL AVIATION. VOLUME 2: APPENDICES B THRU I
Feb. 1971 416 p refs
(Contract DOT-OS-00020)
(NASA-CR-1809; DOT-TST-10-3-Vol-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 01B

The appendices for a historically based analysis of aeronautical research and development are presented. A summary of aeronautical R and D; the aeronautical R and D effort; capsule histories of research areas; and categories of aircraft in terms of performance are included as well as a discussion of methods used to compute noise and pollution contributions of aeronautical systems. Application of input/output analysis to the determination of gross national product and employment contributions of the air transport and civilian aircraft manufacturing industries; a description of the method developed to relate the gross national product contribution of civil aviation to technical advances; and tabular presentation of selected data representing the benefits of civil aviation are also given. J.M.

N71-27088* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HIGH SPEED FLIGHT VEHICLE CONTROL Patent
Robert W. Rainey, inventor (to NASA) Issued 16 Mar. 1971 4 p Filed 30 Jun. 1969 Cl. 244-90; Int. Cl. B64c9/02
(NASA-Case-XLA-08967; US-Patent-3,570,789; US-Patent-Appl-SN-837830) Avail: US Patent Office CSCL 01C

A vehicle is described having supersonic and hypersonic flight capabilities equipped with a pair of elevons on the aft end of the body and disposed with hinge lines swept forward relative to the aircraft centerline at an angle less than 90 deg. Official Gazette of the U.S. Patent Office

N71-27096# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
THE EFFECT OF STEADY TAILPLANE LIFT ON THE SUBCRITICAL RESPONSE OF A SUBSONIC T-TAIL FLUTTER MODEL
D. J. Mc Cue, R. Gray, and D. A. Drane London Aeron. Res. Council 1971 37 p refs Supersedes RAE-TR-68081; RAE-TR-68295; ARC-30732; ARC-31363
(ARC-R/M-3652; RAE-TR-68081; RAE-TR-68295; ARC-30732; ARC-31363) Copyright. Avail: NTIS; HMSO: £1; BIS: $3.60

An aeroelastic model of an aircraft T-tail has been tested in a low speed wind tunnel. The purpose of the program was firstly to check the validity of a method for calculating the aerodynamic forces acting on a T-tail oscillating about zero mean incidence. The secondary purpose was to measure the effect of tailplane incidence on aeroelastic behavior, and to develop a method of calculation to take account of steady lift on the tailplane in the evaluation of flutter and subcritical response. The results of the tests and of the

calculations are presented and it is shown that theory and experiment are in broad agreement, although accurate experimental data becomes difficult to obtain under certain conditions. Author (ESRO)

N71-27087# Aeronautical Research Council (Gt. Brit.).
THE TIME-VECTOR METHOD FOR LATERAL STABILITY INVESTIGATIONS
K. H. Doetsch (RAE, Farnborough, Engl.) 1970 53 p refs Supersedes RAE-TR-67200; ARC-29897
(ARC-R/M-3631; RAE-TR-67200; ARC-29897) Copyright. Avail: NTIS; HMSO: £1.40; BIS: $5.40

Using the time vector method, each equation of motion of an aircraft can be represented by a closed vector polygon, the shape and size of which conveys useful information about the mode of motion under consideration. A graphical method for constructing these polygons is presented and a mechanized system of vector calculators is described in detail. Because of the availability of digital computers, the main use of the method now is in the interpretation of results obtained by computers, giving improved physical insight into aircraft lateral behavior. This application has proved to be particularly fruitful in relation to automatic control phenomena. Several examples are given. Author (ESRO)

N71-27109# National Aerospace Lab., Amsterdam (Netherlands).
EXPERIMENTAL DETERMINATION OF LATERAL-DIRECTIONAL STABILITY AND CONTROL DERIVATIVES IN NON-STEADY FLIGHTS
H. A. Mooij 31 Feb. 1970 71 p refs Sponsored by Neth. Aircraft Develop. Board
(NLR-TR-70038-U) Avail: NTIS

Different methods are investigated for the determination of stability and control characteristics from measurements in non-steady flight. The data reduction methods which were applied comprised various techniques in the time domain as well as in the frequency domain. It is found that a reliable determination of all derivatives requires an all-in error level of the measured primary quantities of 0.1 percent or less. Author (ESRO)

N71-27188# Center for Naval Analyses, Arlington, Va. Inst. of Naval Studies.
A FORECAST OF AIR TRAVEL DEMAND AND AIRPORT AND AIRWAY USE IN 1980
Arthur S. Devany and Eleanor H. Gargas Jan. 1971 49 p refs
(Contract N00014-68-A-0091)
(AD-720732; Rept-163; INS-72-71) Avail: NTIS CSCL 1/2

The demand for air travel between 581 pairs of domestic cities, which comprise 60 percent of total U.S. domestic air travel, is analyzed and forecast to the year 1980. An assessment of operating economies of new wide-body aircraft and alternative trip times likely to be experienced by future air travelers is made to generate assumptions regarding the structure of future fares and trip times by distance. These assumptions are combined with income and population projections for each city and an estimated demand function to forecast levels of passenger travel between each pair of cities. Airline flights between these pairs of cities are projected under 2 patterns of service that may evolve with the further introduction of wide-body jets into commercial service. Author (GRA)

N71-27196# Army Foreign Science and Technology Center, Charlottesville, Va.
THE AIR CUSHION IN INDUSTRIAL TRANSPORTATION
V. M. Khoykhet 22 Feb. 1971 48 p refs Transl. into ENGLISH from the publ. 'Vozdushnaya Podushka v Promyshlennom Transporte' Moscow, Znaniye Press, 1970
(AD-721254; FSTC-HT-23-495-71) Avail: NTIS CSCL 1/3

The theory and operation of air cushion vehicles and othe application of the ground effect are discussed. Off-highway ACVs and air cushion assisted trailers for hauling heavy machinery are described along with such specialized topics as the us of ACVs in icy, desert and swampy areas. Author (GRA)

N71-27220# Johns Hopkins Univ., Baltimore, Md. School of Hygiene and Public Health.
STUDIES OF THE BIRD/AIRCRAFT COLLISION PROBLEMS Final Report
William J. L. Sladen Mar. 1971 16 p refs
(Grant AF-AFOSR-1573-68)
(AD-720889; AFOSR-TR-71-0732) Avail: NTIS CSCL 1/2

It is concluded that the Whistling Swan is an important potential hazard to aircraft during spring and autumn migrations when large concentrations fly at predictable times during a relatively short period. Migration is on a narrow front 100-150 miles wide in the eastern flyway. While enroute they may encounter bad weather causing them to land in unusual stopover places or return to point of departure. Data from radio tagged swans indicate spring migration is a succession of 250 to 700 mile flights interspersed with 10 to 25 day resting periods. Local movements during the winter may be restricted or extensive--the latter is hazardous for small aircraft. Further research needs are documented. Author (GRA)

N71-27320 Lehigh Univ., Bethlehem, Pa.
ON THE RESPONSE OF AIRCRAFT TO MULTIDIMENSIONAL TURBULENT INPUTS
George Trevino (Ph.D. Thesis) 1969 162 p
Avail: Univ. Microfilms Order No. 70-10823

A method is given for determining an approximation to the exact power spectrum of any response of a space-dependent system moving through a multidimensional homogeneous random field. It is shown that the method is equivalent to the approximation of a sine wave by the sum of a constant, straight line, parabola, etc., depending on the order of the approximation. The exact problem is solved for the case of a uniform beam moving through a random pressure field and it is shown that the accuracy of the approximation to the exact power spectrum depends upon the ratio of the dimensions of the beam to a well-defined length parameter of the input. The method is applied to the case of a B-52 airplane flying through atmospheric turbulence and it is shown that the caliber of the results obtained with the approximation is, not only dependent upon the ratio of the airplane dimensions to the scale of turbulence, but also upon the sensitivity of the airplane to certain deterministic inputs. Dissert. Abstr.

N71-27354# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILITY AND CONTROLLABILITY OF SUPERSONIC AIRCRAFT
V. Lutskii et al 4 Dec. 1970 10 p Transl. into ENGLISH from Aviatsiya i Kosmonavtika (Moscow), no. 12, 1969 p 12-22
(AD-721027; FTD-HC-23-598-70) Avail: NTIS CSCL 1/3

In distinction from the subsonic aircraft in which the system of longitudinal control was quite simple and the favorable conditions of controllability fully assured a rigid kinematic coupling of the control stick with the elevator, the control system on supersonic machines is more complex; it includes hydraulic control boosters, automatic loading units, trimmer effect mechanisms and elements increasing the operational reliability. In modern fighters, an adequate effectiveness of the horizontal tail empennage at supersonic flight modes is achieved only in the presence, in the control system, of a fully rotatable control surface, i.e. of a controlled stabilizer. On the supersonic aircraft having limited maneuverability, longitudinal controllability is porvided by the elevator and by a stabilizer which is adjustable during flight. Author (GRA)

N71-27429# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
PHYSICIAN PILOT-IN-COMMAND FLIGHT ACCIDENTS.

1964 – 1970
Albert Cierebiej, Stanley R. Mohler, and V. Geniese Stedman Mar. 1971 9 p refs
(FAA-AM-71-9) Avail: NTIS

It was reported in 1966 that the prevalence of fatal aircraft accidents among physician pilots during 1964 and 1965 was four times that of general aviation pilots. There was a marked drop in the total number of fatal accidents among physician pilots during the years 1966, 1967, 1968 but an increase in 1969 and further increase in 1970. Among all general aviation pilots, there has been a steady decline in fatal accidents since 1968. Author

N71-27429# National Transportation Safety Board, Washington, D.C.
FATIGUE FAILURE OF METAL COMPONENTS AS A FACTOR IN CIVIL AIRCRAFT ACCIDENTS
Willian L. Holshouser and Ruth D. Mayner 1971 22 p Presented at 6th ICAF Symp., Miami Beach, Fla., 12–14 May 1971; sponsored by Intern. Comm. on Aeron. Fatigue
Avail: NTIS

Fatigue failures associated with accidents occurred most frequently in landing gear components, followed in order by power plant, propeller, and structural components in fixed wing aircraft and tail rotor and main rotor components in rotorcraft. In a study of 230 laboratory reports on failed components associated with the cause of accidents, fatigue was identified as the mode of failure in more than 60 percent of the failed components. The most frequently identified cause of fatigue, as well as most other types of material failures, was improper maintenance (including inadequate inspection). Fabrication defects, design deficiencies, defective material, and abnormal service damage also caused many fatigue failures. Four case histories of major accidents are included as illustrations of some of the factors involved in fatigue failures of aircraft components. Author

N71-27664*# Douglas Aircraft Co., Inc., Long Beach, Calif.
A DEMONSTRATION PROGRAM PLAN UTILIZING COMPOSITE REINFORCED METALS FOR THE DC-8 HORIZONTAL STABILIZER STRUCTURE Final Report
P. T. Sumida Jun. 1971 147 p refs
(Contract NAS1-9953)
(NASA-CR-111913; MDC-J5119) Avail: NTIS CSCL 01C

A feasibility study was performed and demonstration programs prepared to demonstrate the application of boron-epoxy reinforced 7075-T6 aluminum structure on the DC-8 aircraft. Preliminary design and feasibility studies were conducted on five candidate DC-8 structural components prior to selection of the horizontal stabilizer for detailed study. Weight savings of eight percent (based on the structural box) were estimated. The recommended demonstration program proposes four additional phases: (1) advanced development tests; (2) detail design and analysis; (3) fabrication of two flight and one test stabilizer; and (4) static proof, ground vibration, fatigue, and ultimate strength tests. In addition, a two year (minimum) flight service period for two horizontal stabilizers on airline DC-8s is planned. An alternate demonstration program proposes two additional phases culminating in the in-flight service experience of a single horizontal stabilizer on an airline DC-8 for approximately one year. Author

N71-27679# Goodyear Tire and Rubber Co., Goodyear, Ariz. Aviation Products Div.
THE DESIGN, DEVELOPMENT, AND FLIGHT TESTING OF FIRE SUPPRESSANT VOID FILLER FOAM KITS FOR VARIOUS TACTICAL ARMY AIRCRAFT Final Technical Report, Jul. 1968 – Oct. 1970
William M. Willisford Oct. 1970 40 p
(Contract DAAJ01-69-C-0039(3G))
(AD-719711; APR-301; USAAVSCOM-TR-70-16) Avail: NTIS CSCL 1/2

Fifteen (15) various Army aircraft were examined to determine if a fire suppressant, void filler foam kit could be designed for each of them that would fill the void space surrounding the lower hemisphere of the fuel tank; thus reducing the susceptibility of the aircraft to fire from incendiary rounds. If the examination indicated that a kit was feasible, a kit was designed, fabricated, installed, and flight tested. No adverse flight characteristics were discovered with any of the foam kits installed. Each of the kits designed will serve the purpose for which it was intended. Author (GRA)

N71-27756# National Aeronautical Lab., Bangalore (India).
WHIRL FLUTTER OF FLAPPED BLADE ROTOR SYSTEMS
K. V. Krishna Rao and Sundararajan Oct. 1969 40 p refs
(NAL-TN-18) Avail: NTIS

With a view to understand the whirl flutter phenomenon in flapped blade rotor systems and also to shed some light in bridging the gap between theoretical and experimental results, the equations of motion of an idealised mathematical model of a multibladed rotor system were formulated. Generalized aerodynamic forces were obtained from quasi-steady blade element theory. These equations were linearised and solved for a symmetric case. The stability boundaries for different hinge offsets of the blades are presented as a nacelle frequency parameter for neutral instability against the blade flapping frequency parameter. It was found that for a particular value of the flapping frequency parameter, which is a function of blade hinge offset and restraint spring constant at the flapping hinge, the nacelle frequency parameter required for neutral instability is minimum. From the results it is shown that an optimum flapping hinge position from the whirl flutter point of view can be determined. Low speed wind tunnel experiments were performed on a simplified model with different hinge offset conditions. Both 10 per cent and 13.6 per cent hinge offsets resulted in backward whirl flutter as predicted by theory. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N71-26896# Massachusetts Inst. of Tech., Cambridge. Div. of Sponsored Research.
RESEARCH ON CHARGED ALKALI COLLOIDS, 23 SEPTEMBER 1968–23 SEPTEMBER 1969
Albert Solbes Wright-Patterson AFB, Ohio ARL Dec. 1970 66 p refs
(Contract F33615-69-C-1114)
(AD-721197; ARL-70-0344) Avail: NTIS CSCL 10/2

The report presents an analysis of the insulating properties of metallic colloids. Low work function materials such as mercury are shown to be desirable. The method of determination of the breakdown strength for a mixture consisting of heavy metallic atoms, liquid droplets and a light neutral gas is presented. A study is included of the kinetics of nucleation for non ideal metallic alloys such as alkali amalgam together with a preliminary study of the condensation problem in a free jet. Finally the problem of charge generation by contact ionization is studied. The metallic vapor continuous loop was modified so as to allow the study of the properties of alkali amalgam vapors. Author (GRA)

N71-26979*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTIC STUDY OF AN ELECTRIC STEPPING MOTOR DRIVE FOR A NUCLEAR REACTOR CONTROL DRUM
Arthur W. Kieffer Washington May 1971 38 p refs

(NASA-TM-X-2297; E-5788) Avail: NTIS CSCL 09E

This study analytically evaluates a stepping motor as a reactor control drum drive (drum weight is approximately 158 kg). Motor performance is evaluated for different load and motor conditions. Failure free operation, where the motor rotates one step increment for each step command, is considered most important. Failures were less frequent when stepping was at a rate that allowed the system to come to rest between steps. A failure free operating region is defined for this type of stepping rate. Author

N71-27089*# McDonnell-Douglas Astronautics Co., Newport Beach, Calif.

DEVELOPMENT OF A HEAT-STERILIZABLE 40-Ah SEALED SILVER-ZINC CELL

A. Himy Washington NASA May 1971 148 p ref

(Contract NAS3-10928)

(NASA-CR-1812; DAC-60989-F) Avail: NTIS CSCL 10C

A heat-sterilizable sealed, nonmagnetic, silver-zinc cell of 40-Ah actual capacity was designed, developed, extensively tested, and fully engineered for fabrication as a unit element to be used in a battery assembly. Originally intended for possible use in a Viking spacecraft mission, it still retains the capability, with or without heat-sterilization, of having at least two years wet life (data beyond two years are still incomplete) and several hundred cycles of various periods (one to three cycles a day) and various depths of discharges (10 to 35 percent of actual capacity). Charged wet stand is greater than one year, with or without trickle charge, in the range of 10 to 42 C. The cell is capable of withstanding all environmental test requirements for launch and soft landing. Author

N71-27162*# Battelle Inst., Frankfurt am Main (West Germany).

CONTINUED INVESTIGATIONS ON THIN FILM SOLAR CELLS BASED ON CdS(x)Te(1−x) MIXED FILMS [WEITERFUEHRUNG DER UNTERSUCHUNGEN UEBER DUENNSCHICHTSOLARZELLEN AUF DER GRUNDLAGE DES CdS(x)Te(1−x)-MISCHSYSTEMS]

D. Bonnet Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Feb. 1971 34 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.

(BMBW-FB-W-71-07) Avail: NTIS; ZLDI Munich: 7,20 DM

The development of a thin film solar cell based on CdS(x)Te(1−x) mixed films with graded energy gaps has been continued. We have established the most important data of the semiconductor system CdS(x)Te(1−x) which are decisive for the construction of the solar cell, i.e. the dependence of energy gap and conductivity on x, as well as crystal structure and quality of the films. Several methods for the p-doping of CdTe films have been studied and used in the fabrication of p-n cells. The fabrication conditions for the cells have been modified stepwise, utilizing the new data of the preceding step especially for solving recombination problems. At the end a cell was developed which produced about 30% to 40% of the short circuit current of a 6.5% Clevite cell. This cell has a potential of three times that current when the charge carrier recombination is reduced and the collection efficiency is increased. Conclusions for the continuation of the work are drawn. Author (ESRO)

N71-27221*# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

USE OF THIN FILM SOLAR CELLS IN RADIOVOLTAIC GENERATORS

R. Bomal, A. Manin, and K. Steinschaden 1970 15 p refs Presented at the Intern. Meeting on Solar Cells, Toulouse, 6−10 Jul. 1970

(CEA-CONF-1623; CONF-700707-1) Avail: AEC Depository Libraries

A radiovoltaic generator was developed, using tritium as a beta emitter and cadmium telluride as a radiovoltaic converter. CdTe is a semiconductor generally used in thin film solar cells and is very cheap. The characteristics of both components and the reason of their choice are given, the generator and its performances are described. NSA

N71-27668*# General Electric Co., Cincinnati, Ohio.

THREE STAGE POTASSIUM VAPOR TURBINE TEST

B. L. Moor and E. Schnetzer Washington NASA May 1971 48 p refs

(Contract NAS3-10808)

(NASA-CR-1815; GESP-547) Avail: NTIS CSCL 21E

A three-stage potassium vapor turbine was tested for 5000 hours in a stainless steel test facility at 18,250 RPM, 1.54 lb/sec nominal vapor flow rate, 1500 F inlet temperature, inlet total/exit static pressure ratio of 10, vapor qualities of 99% (inlet) to 87% (exit), and approximately 235 kw of power. The vapor quality into the third stage inlet was no greater than 93% for 4300 hours. The primary objectives of studying the effects of vapor wetness on impingement damage of different rotor-blade materials, including molybdenum alloys, were met. Rotor blade wear due to impingement was minimal and did not preclude testing beyond 5000 hours. Assessment of molybdenum blade wear by impingement was difficult due to washing corrosion caused by oxygen in the potassium working fluid. Author

N71-27669*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE DESIGN AND OPERATION OF THREE POWER SUPPLIES FOR THE IMP-I SPACECRAFT

Joseph A. Gillis May 1971 40 p

(NASA-TM-X-65566; X-761-71-217) Avail: NTIS CSCL 10B

The three power supplies described include: the encoder converter, the decoder converter, and the plasma experiment low voltage power supply. The reasoning behind the design approach chosen to meet the specifications peculiar to each unit as well as those common to all three units are discussed, and the performance of each unit under all anticipated conditions of operation is presented. Author

N71-27678*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE STATUS OF Cu2S-CdS SOLAR CELL DEVELOPMENT

D. T. Brenatowicz 1971 14 p Presented at the 1971 Intern. Solar Energy Soc. Conf., Greenbelt, Md., 10−14 May, 1971

(NASA-TM-X-67848; E-6347) Avail: NTIS CSCL 10A

The goal of the effort on the Cu2S-CdS thin film solar cell is the development of a low cost alternate to the silicon solar cell for space applications. The performance of current production cells and the results of various environmental tests are presented. A movie describes how the cell is made and tested. Author

N71-27686*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LONG TERM TESTS OF Cu2S-CdS THIN FILM SOLAR CELLS UNDER SIMULATED ORBITAL CONDITIONS

J. J. Smithrick and D. R. Clarke (Boeing Co., Seattle, Wash.) 1971 8 p refs Proposed for presentation at the 1971 Intersociety Energy Conversion Eng. Conf., Boston, 3−6 Aug. 1971; sponsored by the Soc. of Automotive Engr.

(NASA-TM-X-67847; E-6340) Avail: NTIS CSCL 10A

Thin film Cu2S-CdS solar cells were thermally cycled for 10,050 cycles by illuminating them with a xenon-arc solar simulator for one hour and allowing them to cool in the dark for a half hour. This is the longest thermal cycling test of Cu2S-CdS solar cells to date. In another chamber cells have been continuously illuminated for 6,660 hours by an xenon-arc solar simulator. During both tests data were taken periodically to monitor the performance of the

cells. Results of the long term thermal cycling and continuous illumination tests are presented, and the test facilities are described. Author

N71-27697*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SHOCK AND VIBRATION TESTS OF A SNAP 8 TURBOALTERNATOR
Andre J. Stromquist, Lawrence Hibben, and Robert S. Foley (Aerojet-Gen. Corp., Azusa, Calif.) May 1971 27 p refs
(NASA-TM-X-67851) Avail: NTIS CSCL 10A

A turboalternator for the SNAP-8 space power system was subjected to the expected vehicle launch vibration and shock loading in accordance with the SNAP-8 environmental specification. Subsequent disassembly and detailed inspection revealed some internal damage but the unit was judged to be operational. Author

N71-27713*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A BRAYTON CYCLE POWER CONVERSION SYSTEM USING A HELIUM XENON GAS MIXTURE
Alfred S. Valerino and Lloyd W. Ream 1971 16 p refs Proposed for presentation at the 1971 Intersociety Energy Conversion Eng. Conf., Boston, 3–6 Aug. 1971; sponsored by the Soc. of Automotive Engr.
(NASA-TM-X-67846; E-6339) Avail: NTIS CSCL 10A

A Brayton power conversion system was operated in an ambient environment with a gas mixture of helium and xenon. The system was operated at a compressor inlet temperature of 80 F through a compressor discharge pressure range from 20 to 45 psia and through a turbine inlet temperature range from 1300 to 1600 F. Results of system and component performances through the operating range of parameters are discussed. Results of the investigation indicated a net engine efficiency (excluding heat losses from the heat source) of approximately 30 percent at a compressor discharge pressure of 45 psia and a turbine inlet temperature of 1600 F. The gross power output measured at the alternator terminals for this condition was 13.2 kW. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N71-26892# Joint Publications Research Service, Washington, D.C.
EFFECT OF ULTRASOUND ON NUCLEIC ACIDS AND ON THE SKULL
20 May 1971 9 p refs Transl. into ENGLISH from Byull. Eksptl. Biol. i Med. (Moscow), no. 4, 1971 p 58–61 and 120–121
(JPRS-53177) Avail: NTIS

CONTENTS:

1. EFFECT OF ULTRASOUND ON THE CONTENT OF NUCLEIC ACIDS IN RAT ORGANS A. A. Chirkin et al p 1–5 refs (See N71-26893 15-04)

2. STUDY OF THE POSSIBILITY OF LOCAL ACTION OF FOCUSED ULTRASOUND THROUGH PORTIONS OF THE SKULL OF ANIMALS AND OF MAN Yu. S. Inin et al p 6–8 refs (See N71-26894 15-04)

N71-26893# Joint Publications Research Service, Washington, D.C.
EFFECT OF ULTRASOUND ON THE CONTENT OF NUCLEIC ACIDS IN RAT ORGANS
A. A. Chirkin et al *In its* Effect of Ultrasound on Nucleic Acids and on the Skull 20 May 1971 p 1–5 refs (See N71-26892 15-04)
Avail: NTIS

An investigation was conducted to determine the dynamics of changes in the content of DNA and RNA in the organs of white rats after they were exposed to ultrasound. Experiments were performed on 300 male rats weighing from 150 to 200 grams. The animals were exposed to ultrasound at a frequency of 830 kHz and intensities of 0.2, 0.6, and 1.8 w/sq cm. The results indicate that ultrasound produces complex wavelike changes in the nucleic acid content of the animals organs, and that an intensity of 1.8 w/sq cm produces the greatest changes in the DNA and RNA levels. Of the organs tested, the most significant difference in the content of nucleic acids was found in the kidneys, followed by the muscles, skin, intestine, and liver. It is suggested that the reason for this distribution may be that the tissues that possess a complex cellular architecture, as with the kidneys, absorb much more ultrasonic energy than do tissues with a simpler cellular organization, such as fatty tissues and the liver. D.L.G.

N71-26894# Joint Publications Research Service, Washington, D.C.
STUDY OF THE POSSIBILITY OF LOCAL ACTION FOCUSED ULTRASOUND THROUGH PORTIONS OF THE SKULL OF ANIMALS AND OF MAN
Yu. S. Inin et al *In its* Effect of Ultrasound on Nucleic Acids and on the Skull 20 May 1971 p 6–8 refs (See N71-26892 15-04)
Avail: NTIS

An experiment was conducted to determine the possibility of acting with focused ultrasound on local brain structures through the skull of animals and of man. The study was made on portions of the skulls of dead animals and human beings placed in distilled water. Tepler's optical effect was used to visualize the ultrasonic field. The frequency of radiation was 1 mHz and the open angles of the focusing system ranged from 30 to 70 deg. It was found that the geometry of the field did not change when a layer of brain 40 to 50 mm thick was placed in the path of the ultrasonic beam. The focusing of the ultrasound improved when the open angle increased. Analyses of the experimental data indicate that it is theoretically possible for local focused ultrasound to act on the human brain through the skull. However, focused ultrasound passing through the skulls of animals may distort the geometry of the ultrasonic field because of the uneven thickness of cranial bone. D.L.G.

N71-26944# Wyle Labs., Inc., Rockville, Md. Payne Div.
A FOUR-DEGREE-OF-FREEDOM LUMPED PARAMETER MODEL OF THE SEATED HUMAN BODY Final Report, 15 Jun. 1967–15 Jun. 1970
Peter R. Payne and Edward G. U. Band Wright-Patterson AFB, Ohio AMRL Jan. 1971 122 p refs
(Contract F33615-67-C-1807)
(AD-721225; WP-59101-6; AMRL-TR-70-35) Avail: NTIS CSCL 6/19

A four-degree-of-freedom lumped parameter model is tentatively proposed to study the problem of the vertical accelerations of the seated human body such as may be imposed by aircraft ejection systems. The coefficients defining the mass distribution and the spring and damping rates of the connecting links are obtained from experimental data. The way in which these coefficients are derived is described in the report. Development of the model is preceded by a study of the driving point impedance of generalized multi-degree of freedom systems. This study was carried out to determine how much reliance should be placed on experimental impedance measurements in the construction of the model. It is

concluded that a reasonable representation of the dynamics of a seated human subject can be obtained by the four-degree-of-freedom lumped parameter model, but that there exists a surprisingly small amount of usable data, indicating that a sophisticated experimental program should be initiated to examine in detail particular aspects of body dynamics. Author (GRA)

N71-26993*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOUDNESS DETERMINED BY POWER SUMMATION
Walton L. Howes Washington May 1971 14 p refs
(NASA-TM-X-2300; E-6020) Avail: NTIS CSCL 06B

The predicted overall loudness of steady, broad-band noise is usually computed by summing weighted loudnesses of subbands of noise intensity (mean-square pressure) spectrum. It is proposed, instead, that the overall loudness be computed by summing weighted intensities of subbands (critical bands) of noise and then obtaining the loudness of the sum. The proposed computation method seems to yield better agreement with published loudness judgment data than does the usual method. It appears that the proposed method yields better agreement with annoyance judgments than does the perceived noise method of Kryter. Author

N71-27188# Honeywell, Inc., Hopkins, Minn. Corporate Research Center.
ODOR SENSING CELL ULTRASTRUCTURE BY ELECTRON MICROSCOPY Final Report
Herbert E. Heist Dec. 1970 107 p refs
(Contract F44620-68-C-0006)
(AD-720893; AFOSR-TR-71-0712) Avail: NTIS CSCL 6/16

The report is divided into five sections including the effects of octanol and ascorbic acid on the ATPase activities in rabbit olfactory epithelium, the initial studies on immobilized enzymes, the completion of the observations on the regeneration of olfactory cells and centriole migration during regeneration and normal development, and the developments in applying radioautography to olfactory studies. Octanol was found to stimulate the Na-K ATPase activity from olfactory tissue but to inhibit the same activity from brain. Ascorbic acid caused inhibition of Na-K ATPase activity under conditions in which it could readily oxidize to dehydroascorbic acid. Glucose oxidase and urease were immobilized in acrylamide gel which shows good possibilities of being developed into sensing systems. Regeneration of olfactory epithelium may be in the form of olfactory cells or ciliated columnar cells or a mixture, but they all appear to originate from the Bowmans glands. The incidence of centriole migration in variously aged animals and in adult regeneration tissue supports a hypothesis that olfactory cell development persists well into the adult life of the animal. Author (GRA)

N71-27176# Army Foreign Science and Technology Center, Charlottesville, Va.
PHYSIOLOGICAL CRITERIA AND PROCEDURES FOR DETERMINING WORK FATIGUE [O FIZIOLOGICHESKIKH FRITERIYAKH I METODIKE OPREDELENIYA TYAZHESTI RABOTY]
M. V. Leynik 24 Feb. 1971 18 p refs Transl. into ENGLISH from Gigena Truda i Prof. Zabolevaniya (Moscow), v. 4, no. 11, 1960
(AD-721246; FSTC-HT-23-818-70) Avail: NTIS CSCL 6/16

Among the physiological criteria and methods for determining work fatigue, which have taken a firm place in labor physiology, are those of the amount of external mechanical work expressed in kilogram-meters and energy consumption measured by the amount of consumed oxygen or amount of calories expended. This report discusses more accurate means of determining work fatigue, for the above criteria are applicable only for those forms of labor in which a large group of muscles are used. The method for studying work fatigue discussed here is based on the similarity and differences of varied types and forms of work. We present data concerning the indicators and methods for measuring functional stress on the indicated systems during work and the minimum and maximum possible values of this stress. The two kinds of fatigue primarily dealt with are nervous tension and muscular strain. Physical strain is measured by readings of pulse rate at various times during the work day. Fatigue for various types of professional labor can thus be established by the degree of functional stress on the various sytems of the organism. Author (GRA)

N71-27186# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
VARIABILITY IN THE TIMING OF SIMPLE MOTOR RESPONSES
Raymond S. Nickerson 24 Jul. 1970 77 p refs
(Contract F44620-69-C-0115)
(AD-721213; BBN-1952; AFOSR-TR-71-0787) Avail: NTIS CSCL 5/10

Five experiments were conducted to investigate variability in the timing of simple motor responses. The task was to make a response a specified period of time following the occurrence of a signal. Target intervals ranged from 250 msec to 8 sec in the first experiment, and from 250 msec to 2 sec in the others. Absolute variability was measured by the standard deviation and the interquartile range. Three indications of relative variability were used: the ratio of the standard deviation to the mean, the ratio of the interquartile range to the median, and the proportion of responses falling within specified regions of the time distribution. Absolute variability increased with target interval, although the difference between the results obtained with 250 and 500 msec intervals was small. Relative variability was largest with the shortest intervals used. Performance feedback, in the form of an analog display proved to be effective in decreasing variability, at least for the shortest intervals used. Also, variability was further reduced when S was allowed to initiate the interval being judged as well as to terminate it, again with the most pronounced effect being obtained with the shortest intervals. Extensive practice by one S did not reduce variability noticeably. Author (GRA)

N71-27290# Scientific Translation Service Ann Arbor, Mich.
PEROXIDASE AND CATALASE ACTIVITY IN OXYGEN UNDER PRESSURE [AKTIVNOST PEROKSIDAZY I KATALAZY V USLOVIYA KISLORODA POD POVYSHENNYM DAVLENNEM]
S. N. Efuni, Yu. E. Mikhailov, T. S. Fokina, and L. I. Shimkevich Mar. 1971 5 p refs Transl. into ENGLISH from Eksp. Khir. Anesteziol (USSR), V. 15, No. 3, May-Jun. 1970 p 63-65
Prepared for ANL Sponsored by ANL
(ANL-Trans-877) Avail: NTIS

Peroxidase and catalase activity in blood and certain internal organs of white mice was studied under pure oxygen at 5 atmospheres until toxic cramps supervened. Peroxidase activity rose markedly in the peripheral blood and in the leucocytes infiltrating the parenchymatous organs and catalase activity in the blood increased at the expense of erythroctosis (catalase index remained practically unchanged). Marked tissue eosinophilia was found. Data obtained were compared with literature data on increase content of peroxide compounds in the body during oxygen intoxication. It is suggested that increased activity of the enzymes is a sign of physiological adaptation to the toxic action of oxygen. Author

N71-27289# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
BRAIN AND HEART ACCUMULATION OF BROMOTRIFLUOROMETHANE
Ethard W. Van Stee, and Kenneth C. Back Feb. 1971 17 p refs
(AD-721211; AMRL-TR-70-139) Avail: NTIS CSCL 6/20

One hundred seventy-six albino rats were divided into 11 groups of 16 rats each. The rats were exposed by groups to

70-75% CBrF3 in 02 for 5 minutes. The rats were serially killed throughout the exposure and 55-minute postexposure period. The brains and hearts from the rats in 10 of the 11 groups were rapidly excised and placed in vials of heptane. The contents of the vials were subsequently analyzed for CBrF3. Blood samples were obtained from the rats in the 11th group which was treated identically to the other 10 groups. After the first minute of the 5-minute exposure, the concentration of CBrF3 in the brains rose approximately twice as rapidly as the concentration in the hearts. At the end of the 5-minute exposure the brain concentration was approximately 50% greater than the heart concentration. The heart concentration did not differ significantly from the blood concentration. The postexposure rates of decline of the tissue concentrations of CBrF3 were approximately equal. The brain required almost exactly 1 minute longer to reach a given concentration than the heart. Only trace amounts of CBrF3 were detectable beyond 10 minutes postexposure. Author (GRA)

N71-27355# Texas Technological Univ., Lubbock.
PERFORMANCE AND RECOVERY UNDER PROLONGED VIBRATION
M. M. Ayoub and T. M. Khalil (Florida Univ.) 1970 36 p refs
(Contract DAAD05-69-C-0102)
(AD-721014) Avail: NTIS CSCL 5/5

The research was conducted for the purpose of studying the performance and recovery characteristics of men when subjected to relatively long periods of whole-body, vertical vibration. The effect of environment, and of a work/rest schedule, upon performance and recovery were investigated. Analysis of the performance in terms of duration of exposure to vibration was also undertaken. Author (GRA)

N71-27475# State Univ. of New York, Stony Brook. Coll. of Engineering
MATHEMATICAL THEORY OF MOLECULAR CONTROL SYSTEMS Final Report
Sumner N. Levine Mar. 1971 8 p
(Grant AF-AFOSR-1660-69)
(AD-721207; Rept-186; AFOSR-TR-71-0790) Avail: NTIS CSCL 6/3

A brief summary is given of a research program which placed major emphasis on the analysis of problems associated with the effects of surfaces on blood clotting and on the theory of blood clot regulation. This subject is now at the forefront of medical and surgical research because of recent advances in prosthetic materials and artificial organs. Author (GRA)

N71-27647*# St. Louis Univ., Mo. Dept. of Physiology.
EVALUATION OF METAROLIC LOSSES IN WHOLE BODY SWEAT FROM MEASUREMENTS OF SMALL SKIN AREAS
W. van Beaumont Mar. 1971 94 p refs
(Contract NAS9-9630)
(NASA-CR-115031) Avail: NTIS CSCL 06P

The problems of sweat collection from small skin areas and the predictability of whole body sweat constituent losses from the subsequent analysis are discussed. The information is given in tabular and graphical form. Author

N71-27698# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.
COMPARISON OF STATUS VARIABLES AMONG ACCIDENT AND NON-ACCIDENT AIRMEN FROM THE ACTIVE AIRMAN POPULATION
Michael T. Lategola, Vincent Fiorica, Charles F. Booze, Jr., and Earl D. Folk Dec. 1970 19 p refs Supersedes AM-70-18; See N71-21852
(FAA-AM-70-18A; FAA-AM-70-18) Avail: NTIS

The distribution of age, weight, height, body weight/body surface area and ponderal index for the accident versus nonaccident segments of the active airman population were compared for years 1956–1967. The differences in the distributions of these five status variables in the accident versus nonaccident population segments were statistically significant in all instances. The accident rate increased with age and was highest for ages of 60 or greater. The accident rate also increased with the variables related to increasing body weight. The interrelationship between age and body weight represents the most obvious focus for future research efforts. Various paired combinations of age with each of the other four variables are potentially capable of narrowing the focus of where, within the active airman population, to search for undetected human factors associated with accidents. Author

N71-27743*# Hawaii Univ., Honolulu.
THE PERFORMANCE AND CAPABILITIES OF TERRESTRIAL ORGANISMS IN EXTREME AND UNUSUAL GASEOUS AND LIQUID ENVIRONMENTS
S. M. Siegel Feb. 1971 25 p refs *Its* Hawaii Botanical Sci. Paper No. 21
(Grant NGR-012-001-042)
NASA-CR-118883) Avail: NTIS CSCL 06M

Three inhibitor studies are presented dealing with substances that possess the ability to inactivate terrestrial organisms. The studies described include: (1) biological activity in psilotin, a phenolic glucoside from the psilotales; (2) toxicology and metabolism of manganese; and (3) anomalous deuterium isotope effect on selected enzymes. Significant findings in the studies indicate that the properties of psilotin might be of ecological importance in reducing competitive pressures in stands of the plant species bearing it, and the existence of mechanisms for precipitation of MnO2 may determine species distribution in Mn-rich soils. In addition, the differential effects of moderate D2O levels on the akinetics were demonstrated. D.L.G.

N71-27784*# AiResearch Mfg. Co., Los Angeles, Calif.
LONG-DURATION EXERCISE AT MODERATE WORK LOADS
W. Sanborn, V. B. Dunn, A. Camacho, and E. C. Wortz May 1971 105 p refs
(Contract NAS9-10994)
(NASA-CR-115033; Rept-71-7424) Avail: NTIS CSCL 06S

The results of a research program on the metabolic effects of long duration exercise are tabulated. The subjects, methods, procedures, apparatus, data, and conclusions drawn from a series of experiments in which the duration of the rest break in each hour, the water intake, the amount of sleep, and the overall duration of exercise were varied, are described. The principal exercise mode was an 8-hr walk on a level surface at a velocity of 3.2 mph, which roughly corresponds to an energy expenditure of 1000 Btu/hr. Balke tests conducted to provide exercise correlative and physical fitness information included pre- and post-experiment tests and two sets of tests utilizing a bicycle ergometer. Author

N71-27794*# Food and Drug Administration, Cincinnati, Ohio. Div. of Microbiology.
ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Progress Report, 1 Jan.–31 Mar. 1971
J. E. Campbell May 1971 19 p Prepared in part by CDC, Phoenix, Ariz. and the Spacecraft Biossay Lab., Cape Kennedy, Fla.
(NASA Order R-36-015-001)
(NASA-CR-118870; QPR-24) Avail: NTIS CSCL 06M

A continuing study is described aimed at the development of an experimental system capable of detecting the acceptable levels of contamination. Efforts reported include: (1) a plan to test terminal sterilization cycles for unmanned landers, (2) a suggested outline for evaluation of thermal sterilization cycles, (3) current

status of equipment and experimental methods, and (4) a preliminary evaluation of the system. D.L.G.

N71-27991*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BACTERIAL ADENOSINE TRIPHOSPHATE AS A MEASURE OF URINARY TRACT INFECTION Patent Application
Emmett Chappelle and Grace L. Picciolo, inventors (to NASA) 31 p Filed 4 Aug. 1970
(NASA-Case-GSC-11092-1; US-Patent-Appl-SN-60950) Avail: NTIS CSCL 06M

A rapid and routine procedure is developed for detecting and counting the bacteria present in urine samples, determining thereby the extent of urinary tract infection. The method depends on the presence and determination of adenosine triphosphate which is a nucleotide present in all known living matter, the quantitative determination being a measure of the light emitted in the bioluminescent reaction of the adenosine triphosphate with the firefly enzyme luciferase. NASA

N71-27992*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUTOMATIC INSTRUMENT FOR CHEMICAL PROCESSING TO DETECT MICROORGANISMS IN BIOLOGICAL SAMPLES BY MEASURING LIGHT REACTIONS Patent Application
Burton N. Kelbaugh, Grace L. Picciolo, Emmett Chappelle, and Maurice E. Colburn, inventors (to NASA) 51 p Filed 4 Aug. 1970
(NASA-Case-GSC-11169-1; US-Patent-Appl-SN-60882) Avail: NTIS CSCL 06M

An automated apparatus for sequentially assaying urine samples for the presence of bacterial adenosine triphosphate (ATP) is described. The apparatus includes a rotary table which carries a plurality of sample containing vials; a dispensing means which automatically dispenses fluid reagents into the vials at predetermined times preparatory to injecting a light producing luciferase-luciferin mixture into the samples; and an indicating means which automatically measures the light produced in each urine sample by a bioluminescence reaction of the free bacterial adenosine triphosphate with the luciferase-luciferin mixture. The light measured is proportional to the concentration of bacterial adenosine triphosphate which, in turn, is proportional to the number of bacteria present in the respective urine sample. After the light measurement is performed, the vials are ejected from the table. NASA

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N71-26801# Human Resources Research Organization, Alexandria, Va. Div. 6 (Aviation).
EQUIPMENT DEVICE TASK COMMONALITY ANALYSIS AND TRANSFER OF TRAINING
Paul W. Caro Jun. 1970 37 p refs
(Contract AHC19-70-C-0012)
(AD-709534; HumRRO-TR-70-7) Avail: NTIS CSCL 5/9

Procedures were developed to enable training personnel to systematically and objectively determine the potential utility of training devices for teaching how to perform missions in operational equipment. The procedures allow comparison of operational task stimulus and response elements with corresponding elements in synthetic training equipment. On the basis of such information, training programs consistent with the psychological principles underlying transfer of training may be developed. The procedures may be applied to the potential use of training equipment in a training situation other than that for which it was designed, or in determining the applicability of off-the-shelf training devices to specific training requirements. The procedures, termed task commonality analysis, were developed in connection with an Army rotary wing instrument flight training program. In an application of the procedures in that program, transfer of training predictions were generally consistent with empirical evidence collected earlier. Author

N71-26805*# Republic Aviation Div., Fairchild Hiller Corp., Farmingdale, N.Y.
HOUSEKEEPING CONCEPTS FOR MANNED SPACE SYSTEMS DATA BOOK. VOLUME 1: WASTE CONTROL TASKS AND SYSTEM CONCEPTS (DRL LINE ITEM NO. 4)
30 Oct. 1970 292 p refs
(Contract NAS9-10662)
(NASA-CR-115045; MS124Y0002-Vol-1) Avail: NTIS CSCL 22B

Parametric data on the waste control aspects of housekeeping for future manned orbital spacecraft are presented. Subjects discussed are: (1) identification of waste products, (2) utilization processes, (3) pretreatment processes for disposal, (4) waste disposal, (5) waste control and housekeeping, and (6) systems for sanitation control. Author

N71-26806*# Republic Aviation Div., Fairchild Hiller Corp., Farmingdale, N.Y.
HOUSEKEEPING CONCEPTS FOR MANNED SPACE SYSTEMS DATA BOOK. VOLUME 3: WASTE CONTROL SEARCH/REPORT COMPUTER PROGRAM (DRL LINE ITEM NO. 4)
30 Oct. 1970 684 p refs
(Contract NAS9-10662)
(NASA-CR-115038; MS124Y0002-Vol-3) Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

The computer program which has been developed to store and process the available data on spacecraft waste control is described in Volume 1, Section 7; a detailed description of the program is contained in the user's manual (F/H Report MS 124Y0005). This volume of the data book contains a brief description of the organization of the data, a complete printout of the data, and a description of the search and retrieval capabilities provided. Author

N71-26807*# Republic Aviation Div., Fairchild Hiller Corp., Farmingdale, N.Y.
HOUSEKEEPING CONCEPTS FOR MANNED SPACE SYSTEMS DATA BOOK. VOLUME 2A: WASTE DEFINITION (DRL LINE ITEM NO. 4)
30 Oct. 1970 339 p refs
(Contract NAS9-10662)
(NASA-CR-115046; NS124Y0002-Vol-2A) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

The definition of waste products that could result from manned spacecraft systems having various combinations of mission activities and subsystems is presented. The definition of the waste is in a form that is meant to enhance the derivation of requirements and constraints on waste control housekeeping routines and equipments for various mission configuration. The definition includes identification of waste types and quantities and deals with small, medium, and large spacecraft presently being considered by the NASA agencies or studied by the aerospace industry. The mission limits include up to 100 men, a 10-year mission duration, a 30-day resupply interval, a 300-nautical mile near earth orbit, and a 55-degree orbit inclination. Author

N71-26808*# Welson (B.) and Co., Inc., Hartford, Conn.
HABITABILITY: GARMENT CONCEPTS AND ENGINEERING DATA Final Report
4 Dec. 1970 140 p
(Contract NAS9-10407)
(NASA-CR-115044) Avail: NTIS CSCL 06Q

The development of space suits for use in space station applications is discussed. Subjects presented are: (1) wardrobe definition, (2) fabric usage, (3) laundry system concepts, (4) wardrobe packaging, (5) candidate fabric testing, and (6) crewman sizing. Author

N71-26885# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
BINARY-CLASSIFICATION REACTION TIME: A REVIEW OF SOME STUDIES OF HUMAN INFORMATION PROCESSING CAPABILITIES
Raymond S. Nickerson 23 Dec. 1970 198 p refs
(Contract F44620-69-C-0115)
(AD-721199; BBN-2004; AFOSR-TR-71-0780) Avail: NTIS CSCL 5/10

The paper reviews some recent binary-classification experiments in which the primary performance measure was response time. The defining property of a classification task is that the number of admissible stimuli is greater than the number of response alternatives stimuli are mapped onto responses in a many-to-one fashion. For a binary-classification task, the number of response alternatives is two. Two types of binary-classification tasks are discussed, character-classification, or memory-scanning, tasks, and tasks involving same–different judgments. Same–different judgments are viewed as binary classifications inasmuch as the number of response alternatives is limited to two, whereas the number of stimulus alternatives typically is not. The theoretical thread that links the studies reviewed is the distinction between serial and parallel modes of processing information. Author (GRA)

N71-26909*# Life Systems, Inc., Cleveland, Ohio.
DEVELOPMENT OF A LABORATORY BREADBOARD MODEL OF A CHLORINE GENERATING DEVICE TO CHLORINATE RECLAIMED WATER ON A SPACECRAFT Final Report
F. H. Schubert and R. A. Wynveen Dec. 1970 34 p refs
(Contract NAS1-9917)
(NASA-CR-111854; ER-133) Avail: NTIS CSCL 06K

The application of the chlorination process to water reclamation for advanced life support systems was investigated. The device consists of three series electrolytic cells. A Cl2 generator that produces Cl2 flow rate proportional to current and quantity proportional to the integration of current over time. A by-product, hydorgen gas, is also produced. This H2 is immediately consumed in the second electrolytic cell. The third cell is an electrochemical valve that also performs a Cl2 flow metering function. A laboratory breadboard of the system was designed and tested. It consisted of three cells integrated together and a test control and instrumentation console. The latter was used to obtain characterization data during the test program. The total power required by the three components was less than 1/2 to 0.2 watts for the generator, 0.02 watts for the valve and no power required by the eliminator. The gases were found to be generated in a pure form. A continuous operating test was carried out after the parametric studies. A total of 788 hours were accumulated prior to shutdown for materials evaluation. The selected materials of construction were found to be stable. The device is ready for integrating into a complete water disinfecting system. A minimum form of the latter includes a Cl2-into-water dispenser and a chlorination level detector and feedback control loop in addition to the electrolytic feed supply. Author

N71-26914# Siemens-Schuckertwerke A. G., Erlangen (West Germany).
SMALL ROD-SHAPED SILICON-DETECTORS FOR MEDICAL AND BIOLOGICAL APPLICATIONS [SILIZIUM-MINIATURZAEHLER FUER MEDIZINISCHE UND BIOLOGISCHE ANWENDUNGEN]
O. Jaentsch, P. Glasow, and W. Grosse Aug. 1970 57 p refs In GERMAN
(BMBW-FBK-70-15) Avail: AEC Depository Libraries

It is shown that diffused Si-detectors for medical and biological applications can be manufactured only with high expense. Their spectrum is continuous even for monoenergetic radiation. This can be explained theoretically by using a RC delay line as equivalent circuit of the detector. Author (NSA)

N71-27160# New York Univ., N.Y. Dept. of Industrial Engineering and Operations Research.
EVOKED POTENTIALS AND VISUAL INFORMATION PROCESSING Annual Summary Report, 1 Apr. 1970–31 Mar. 1971
John L. Andreassi and Mark S. Mayzner 31 Mar. 1971 83 p refs
(Contract N00014-67-A-0467-0009)
(AD-720750; Rept-0-5511-356-2; ASR-2) Avail: NTIS CSCL 6/16

Five experiments were conducted. The first study was concerned with the nature of the visual evoked potential (VEP) at, above and below two-flash threshold. The second experiment explored the nature of the VEP under conditions of sequential blanking. In the third experiment VEPs were recorded under conditions in which the normally blanked stimuli and blanking stimuli were alternately increased in luminance. The fourth experiment involved the recording of evoked potentials from four different cortical areas under conditions of sequential blanking. The final experiment of this years report investigated VEPs as a function of three different stimulus configurations and one additional stimulus condition termed sequential displacement. Author (GRA)

N71-27234* North American Aviation, Inc., Downey, Calif.
VIBROPHONOCARDIOGRAPH Patent
Lester N. Wright and Peter Barker, inventors (to NASA) Issued 16 Feb. 1971 5 p Filed 10 Apr. 1968 Cl. 128-2.05; Int. Cl. A61b5/02 Sponsored by NASA
(NASA-Case-XFR-07172; US-Patent-3,563,232; US-Patent-Appl-SN-720041) Avail: US Patent Office CSCL 06B

An apparatus is described for monitoring cardiac dynamics comprising an extremely low weight and small volume piezoelectric microphone with an amplifier having high input impedance for high sensitivity and low frequency response in a dynamic range of from about 2 to 2,000 cycles per second.
Official Gazette of the U.S. Patent Office

N71-27251*# Bunker-Ramo Corp., Canoga Park, Calif. Defense Systems Div.
HUMAN PERFORMANCE PREDICTION IN MAN MACHINE SYSTEMS. VOLUME 3: A SELECTED AND ANNOTATED BIBLIOGRAPHY
Dorothy L. Finley, Richard W. Obermayer, C. M. Bertone, David Meister, and Frederick A. Muckler Aug. 1969 370 p refs
(Contract NAS2-5038)
(NASA-CR-73428) Avail: NTIS HC$6.00/MF$0.95 CSCL 05H

Selected and annotated bibliographies of human performance prediction in man machine systems are presented. The information is presented in three areas: (1) methodological literature, (2) descriptions, data, and applications of tests, and (3) manned space vehicles. Author

N71-27279# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
THE HYDRODYNAMICS OF ROLLER PUMPS AND THEIR

IMPLICATION TO HEMOLYSIS Final Report
Michel Y. Jaffrin and James R. Meginniss Feb. 1971 38 p refs *Its* Fluid Mech. Lab. Publ. No. 71-1
(Contract N00014-67-A-0204-0008)
(AD-720320) Avail: NTIS CSCL 6/12

The peristaltic flow inside the tube of a roller pump is investigated with the assumptions that the fluid is Newtonian and that viscous forces dominate inertia. The output of the pump and the pressure and shear stress distributions are given in closed form as a function of the occlusion setting, the pressure head, the roller and tube diameters and the speed of rotation. It is found that conventional roller pumps with circular rollers generate very high stresses concentrated around the point of minimum radial gap in the tube. These shear stresses are equal or larger than the critical threshold for initiation of hemolysis reported in the literature. The analysis predicts that these concentrated high shear stresses are greatly reduced, to values much below the critical level, if the compression mechanism maintains a gap of uniform thickness over a finite length. Author (GRA)

N71-27476# Aeronautical Research Labs., Melbourne (Australia).
SIMULATED FREE FALL OF A STUNT MAN
B. M. Hearn, S. R. Serrailhe, and A. P. Vulcan Aug. 1970 12 p refs
(ARL/SM-353) Avail: NTIS

An instrumented dummy drop was carried out to simulate the free fall of a stuntman who jumped 63 ft and landed without injury on a pile of cardboard boxes 3 ft high. The dummy deceleration was measured to provide further information on human tolerance to impact. Author

N71-27477# American Inst. for Research, Pittsburgh, Pa.
DEVELOPMENT OF A TAXONOMY OF HUMAN PERFORMANCE: A REVIEW OF THE THIRD YEAR'S PROGRESS
Edwin A. Fleishman and Robert W. Stephenson Sep. 1970 79 p refs
(Contracts DAHC19-71-C-0004; F44620-67-C-0116; ARPA Order 1032; ARPA Order 1823)
(AD-721217; AIR-R70-11; AIR-726-9/70-TPR3; AFOSR-TR-71-0052; TPR-3) Avail: NTIS CSCL 5/10

The purpose of the taxonomy project is to develop and evaluate systems for describing and classifying tasks which can improve generalization of research results about human performance and to develop a common language for communicating between researchers and individuals who need to apply research to personnel problems. The ability-requirement and task characteristics approaches were used to post-dict mean values of performance measures and relevant factor loadings for a variety of tasks. Author (GRA)

N71-27600# Dunlap and Associates, Inc., Santa Monica, Calif.
PREDICTIVE AND ADAPTIVE PROCESSES IN THE CONTROL OF AIR FORCE SYSTEMS Annual Report
Charles R. Kelley and Daniel J. Prosin 30 Jul. 1970 68 p refs
(Contract F44620-69-C-0129)
(AD-721220; AFOSR-TR-71-0779; AR-1) Avail: NTIS CSCL 5/9

The objective of this project is to investigate adaptive and predictive processes in planning, decision, and control systems. Real and fast time analog computing equipment were connected via an especially developed interface device to a desk top digital computer, to form together a unique small laboratory facility for studying adaptive and predictive processes and devices. In this first year of the project, three experimental studies of prediction in manual control were conducted. A display blanking technique established that the operators error in predicting the outcome of his control actions is very nearly proportional to the length of time ahead that he predicts. This result held for second and third order controlled elements throughout the range of prediction times of concern in predictive control (1 to 9 seconds in these studies). A functioning predictive model of the human operator was then mechanized which showed many of the characteristics of manual control, including an insensitivity to changes in controller signal gain that is typical of human operators but not of non-predictive forms of human operator model. The final study utilized the display blanking technique again to show that prediction: reflected tearing in a manual control loop; was very sensitive to operator loading via a secondary tracking task; and was highly resistant to effects of operator fatigue. Author (GRA)

N71-27719*# National Aeronautics and Space Administration, Washington, D.C.
BIOMEDICAL RESEARCH AND COMPUTER APPLICATION IN MANNED SPACE FLIGHT
Jefferson F. Lindsey and John C. Townsend, eds. 1971 206 p refs
(NASA-SP-5076) Avail: NTIS; SOD $2.00 CSCL 06B

The areas of medicine in which computers can be employed are summarized and several cases where computers were applied in connection with the medical aspects of NASA's manned space flight program are examined in detail. Such problems are treated as those of automated medical data storage and retrieval systems, continuous monitoring and interpretation of electrocardiograms, and computer-aided medical diagnosis. Emphasis is placed on ways to permit the computer to perform various clerical functions while leaving critical decisions to a human monitor. Author

N71-27732# European Nuclear Energy Agency, Paris (France).
INFORMATION BULLETIN ON ISOTOPIC GENERATORS, NO. 10
Nov. 1970 55 p refs Prepared jointly with CEA, Saclay
(NP-18563) Avail: AEC Depository Libraries

The development of sealed Pu-238 sources for implantable cardiac pacemakers is reviewed. The safety requirements for such sources and methods for testing the chemical, mechanical, radiological, and thermal safety of isotopic batteries are discussed. NSA

N71-27742*# Omnitech, Inc., Dudley, Mass.
DESIGN, DEVELOPMENT AND PRODUCTION OF PRESSURE SUIT SPECTACLES Final Report
Albert J. Laliberte 31 Mar. 1971 41 p refs
(Contract NAS9-9866)
(NASA-CR-115039) Avail: NTIS CSCL 06Q

Research and development tasks were carried out to design, develop, and fabricate an improved protective spectacle for use in the Apollo pressure suit. A total of 150 such spectacles, of five different types, having various attenuative and transmissive characteristics in the ultraviolet, visible, and infrared region of the spectrum were produced. Author

N71-27770*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
DEVELOPMENT OF A PROTOTYPE WASTE COLLECTION SYSTEM (THE MODIFIED HYDRO JOHN)
J. K. Mangialardi and R. W. Murray 31 Mar. 1971 101 p
(Contract NAS9-9741)
(NASA-CR-115040; Doc-71505211) Avail: NTIS CSCL 06K

The modified Hydro John is a fecal waste management system which combines the salient features of two previously developed concepts. The feces are disposed of and stored as in previous Dry John systems. An anal flush replaces the use of toilet tissue as in previous Hydro John systems. The modified Hydro John is completely automatic and is designed for use in either zero or one gravity environment. The operation of the system consists of four basic steps in sequence: collection of the solid matter; pumping of the solids to a storage container; and flushing and

drying; and vacuum drying of the solid matter in the storage container. The system was designed, developed, and tested for the National Aeronautics and Space Administration. Author

N71-27788*# Hamilton Standard, Windsor Locks, Conn.
ADVANCED EXTRAVEHICULAR PROTECTIVE SYSTEM Interim Report, 1 Jul. 1970 – 31 May 1971
James G. Sutton, Phillip F. Heimlich, and Edward H. Tepper 31 May 1971 135 p refs
(Contract NAS2-6021)
(NASA-CR-114320) Avail: NTIS CSCL 06K

General conclusions and recommendations are reported emanating from an Advanced Extravehicular Protective System (AEPS) study program to provide a meaningful appraisal of various regenerable and partially regenerable portable life support system concepts for EVA use in the 1980's and to identify the required new technology areas. The space station, lunar base, and Mars AEPS specifications (Revision B) are given. A detailed description of the study methodology utilized in the conduct of the AEPS study is presented as well as the subsystem and system study summaries. New technology requirements and recommendations are discussed. A complete bibliography of the texts and references utilized in the conduction of the effort is listed. Author

N71-27983*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
IMPLANTABLE BIOTELEMETRY SYSTEMS
Thomas B. Fryer Washington 1970 119 p refs
(NASA-SP-5094) Avail: NTIS; SOD $0.55 CSCL 06B

Biotelemetric systems for monitoring physicological parameters internally and externally in animals are described. The circuit designs are discussed with emphasis on miniaturization and low power consumption. Also examined are the effects of moisture, pressure, temperature, and environment on the transmission power of the systems. E.H.W.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N71-26841# Martin Marietta Corp., Orlando, Fla.
INVESTIGATION OF MOLECULAR CONSTITUENTS IN THE ATMOSPHERE Final Report, 1 Dec. 1967 – 1 Dec. 1970
Meyer Lichtenstein and James J. Gallagher 20 Dec. 1970 6 p refs
(Contract F19628-68-C-0146)
(AD-721187; OR-11015; AFCRL-71-0006) Avail: NTIS CSCL 7/4

The research objectives were attained on the ozone molecule. Sixty-six rotational transitions previously unobserved in O3 have been located in the region from 50 GHz to 316 GHz and accurate frequency measurements were performed on each transition. In addition to these measurements, Stark and Zeeman studies were performed on several transitions; pressure broadening in O3 was studied for linewidth measurements. Six transitions in SO2 were observed and frequency measurements taken in the region from 280 GHz to 2862 GHz; two new D2O transitions were observed. Stark effect studies were performed on the H2O and H2S molecules, providing data for the re-evaluation of the dipole moments for these molecules. A search for transitions arising from excited energy levels in H2O and HCN molecules was undertaken. Author (GRA)

N71-26888# McElroy (Ralph), Co., Austin, Tex.
CLASSIFICATION OF THE LANTHANIDES AND ACTINIDES INTO THE PERIODIC SYSTEM [EINGLIEDERUNG DER LANTHANIDEN UND ACTINIDEN IN DAS PERIODENSYSTEM]
H. D. Hardt Jan. 1971 7 p ref Transl. into ENGLISH from Naturw. Rundschau (Stuttgart), v. 22, no. 7, 1969 p 302–305
Sponsored by AEC Prepared for Calif. Univ., Livermore. Lawrence Radiation Lab.
(UCRL-Trans-10510) Avail: NTIS

A revised periodic table, including the lanthanides in 3 columns so that f-0, f-7, and f-14 elements fall under each other, with Eu and Yb displaced to the left between the alkaline earths and Gd and Lu, respectively, is suggested. Such a rearrangement coordinates data for melting points, atomic volumes, electron configuration, metallic structure, and colors of the M(III) ions in a periodic fashion. The arrangement also accounts for the position of Y(III) in the basicity series for the lanthanides. The lanthanides thus become a transition within a transition series, but with vertical divisions. A similar decomposition of the actinide series is proposed, with Cm below Ac, and Lw below Cm; again, Am and No are displaced to the left, between the alkaline earths and Ac. NSA

N71-26887# Oak Ridge National Lab., Tenn.
ON THE THERMAL DISSOCIATION AND SUBLIMATION OF UO2F2
O. Knacke et al Feb. 1971 7 p refs Transl. into ENGLISH from Z. Anorg. Allgem. Chem. (Leipzig) no. 371, 1969 p 32–37
Sponsored by AEC
(ORNL-tr-2422) Avail: NTIS

The thermal dissociation 3UO2F2 = 2/3U2O8 + UF6 + 1/3O2 was investigated between 760 and 800 C by the Knudsen effusion method. From the amount of uranium oxide formed during the reaction, the dissociation constant was calculated to be 4.575 log K = 90740/T + 62.36. Besides dissociation, evaporation of UO2F2 takes place with a vapor pressure of the order 0.01 to 0.1 torr in the temperature range investigated. Author (NSA)

N71-26888# TRW Systems Group, Redondo Beach, Calif.
TRIPLET TO TRIPLET ABSORPTION IN ORGANIC MOLECULES FOR USE IN PHOTOCHROMIC DEVICES Final Report, 1 Oct. 1969 – 31 Dec. 1970
John L. Kropp and Maurice W. Windsor Wright-Patterson AFB, Ohio AFML Mar. 1971 78 p refs
(Contract F33615-69-C-1052)
(AD-721239; TRW-12194-6006-R0-00; TRW-12194-6010-R0-00; AFML-TR-71-39) Avail: NTIS CSCL 7/4

The photochromic behavior of hetero-aromatic molecules was studied. Particular attention has been given to the transient absorption in the polymer host poly(methyl methacrylate). Compounds studied include 1,2:5,6 dibenzacridine, dibenzo(c,g)carbazole, 6 aminochrysene and alpha-naphthoflavone. The latter two compounds show little triplet-triplet absorption, however, the former two compounds do show good absorption. The effect of varying concentration upon T-T absorption was studied and high concentrations (0.01M) seem to show lower intensities of triplet absorption than do some less concentrated samples. The degradation of the samples under exposure to sunlight and an Hg lamp are studied. The degradation due to sunlight is found to be partially reversed overnight. Dibenzo(c,g)carbazole shows far more degradation than does 1,2:5,6 dibenzacridine. Further possible uses of photochromics in military applications are considered. Author (GRA)

N71-27064# California Univ., Berkeley. Lawrence Radiation Lab.
SOLUBILITY OF GASES IN GLASS
James Floyd Shackelford (Ph.D. Thesis) Jan. 1971 66 p refs
(Contract W-7405-eng-48)
(UCRL-20399) Avail: NTIS

The statistical thermodynamics of the gas-in-glass system provides a basic model of the solubility. Equations are derived which give the solubility (in atoms or molecules per cubic centimeter of glass) as a function of gas pressure, temperature, fundamental constants, and material parameters. Three main categories of solubility are considered: (a) physical solubility of monatomic gases, (b) physical solubility of polyatomic gases, and (c) chemical solubility of polyatomic gases. The results for (a) and (b) are essentially equivalent. The results for (c) are dependent upon the specific system involved. Case (a) was observed for helium and neon in fused silica. Variations of the thermal history of the fused silica did not appear to have a measurable effect on physical solubility as evidenced in the helium data. Case (b) was observed for hydrogen in fused silica. Physical solubility was measured by a modified Seiverts' technique and was characterized by a linear dependence on pressure. Binding energies for the physically dissolved species were of the order expected for van der Waals bonding. Author

N71-27125# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
GAS CHROMATOGRAPHIC STUDIES OF RAPID REPEATED INJECTIONS OF SAMPLES INTO A COLUMN
Donald Macnaughtan, Jr. and L. B. Rogers [1970] 27 p refs
(Contract AT(11-1)-1222)
(COO-1222-43) Avail: NTIS

Computer simulation and laboratory studies were made of quantitative analyses obtained by overlapping of two or more chromatograms in a single column. Using a high precision chromatograph, the compromises between extent of overlap, which increased as the sample injection interval decreased, and the resulting accuracy and precision were examined. Overall, rapid repeated injections permit a more nearly continuous analysis of a sample stream using a single chromatographic column. One potentially valuable special case was discovered which involves summing the peaks of more strongly held components. In a second important case, a virtual deconvolution of overlapped peaks can be accomplished. In a third case, excessive peak tailing was shown to disappear under appropriate conditions. Author

N71-27202# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Department de Chimie.
SEMIANNUAL REPORT OF THE CHEMISTRY DEPARTMENT, JUNE–NOVEMBER 1969 [RAPPORT SEMESTRIEL DU DEPARTEMENT DE CHIMIE, JUIN–NOVEMBRE 1969]
Jul. 1970 533 p refs In FRENCH; ENGLISH summary
(CEA-N-1341; SAR-8) Avail: AEC Depository Libraries

Techniques and equipment developed for chemical analyses are summarized including volumetry, coulometry, atomic absorption, and pulse polarography as well as nuclear emission, X-ray fluorescence, and mass spectrometric methods. Precipitation, ion exchange, pulsed-air evaporation, and bacterial methods developed for the treatment of radioactive effluents are outlined. Problems in the conversion of UF6 into UO2 are discussed as well as a technique for producing U3O8 standards for emission spectroscopy. Tungsten crucible electroforming, ion exchange processes between Pyrex glass and eutectics, and chromium-nickel deposition by thermal diffusion and saline mist corrosion are cited. Corrosion studies concerning steam generators for fast-neutron reactors, cracking of Inconel 600-type alloys, graphite effects on stainless steel, and sea water oxygen content effects on corrosion are discussed. Aqueous and dry reprocessing methods for semiwastes are also mentioned along with the preparation and study of actinide elements. J.M.

N71-27264* Peninsular Chemresearch, Inc., Gainesville, Fla.
HYDROXY TERMINATED PERFLUORO ETHERS Patent
Eugene C. Stump, Jr. and Stephen Eugene Rochow, inventors (to NASA) Issued 13 Apr. 1971 3 p Filed 24 Oct. 1968 Cl. 260-615; Int. Cl. C07c43/00 Sponsored by NASA
(NASA-Case-NPO-10768; US-Patent-3,574,770; US-Patent-Appl-SN-770398) Avail: US Patent Office CSCL 07C

The initial formation of highly fluorinated diols containing ether linkages and having the general formula $HOCH_2CF(CF_3)(OCF_2CF(CF_3))_mO(CF_2)_pO(CF(CF_3)CF_2O)_nCF(CF_3)CH_2OH$ where p is an integer of 2 to 12, and m and n are integers whose sum is from 0 to 20 is described. The materials are prepared by reducing the acid fluoride terminated precursors by reaction with a reducing agent such as lithium aluminum hydride or an alkali metal borohydride. The hydroxyl terminated ethers are useful as intermediates in the preparation of various materials and particularly in the formation of polymers. They were utilized to formulate polyurethanes by reacting the diols with a suitable diisocyanate. Official Gazette of the U.S. Patent Office

N71-27383* Grace (W. R.) and Co., Clarksville, Md.
METAL CONTAINING POLYMERS FROM CYCLIC TETRAMERIC PHENYLPHOSPHONITRILAMIDES Patent
Robert M. Murch and Thomas Bieniek, inventors (to NASA) Issued 16 Feb. 1971 6 p Filed 18 Mar. 1968 Cl. 260-2; Int. Cl. C08g33/16; Int. Cl. C07d105/02 Sponsored by NASA
(NASA-Case-HQN-10364; US-Patent-3,563,918; US-Patent-Appl-SN-713616) Avail: US Patent Office CSCL 07D

New polymers were prepared which contain both cyclic tetrameric tetraphenylphosphonitrilic units and transition metal salts containing metallic cations chosen from the group consisting of copper (II), cobalt (II), nickel (II), and iron (II). These polymers are unique in phosphonitrilic chemistry in that they are soluble in common organic solvents and are thermally stable above 500 C. Official Gazette of the U.S. Patent Office

N71-27387# Reilly Translations, Gardena, Calif.
CONTRIBUTION TO THE STUDY OF THE ELECTROCHEMICAL PROPERTIES OF INDIUM AMALGAMS
Jean-Francois Rielland et al Jan. 1969 18 p refs Transl. into ENGLISH from La Faculte des Sci. de Paris report Prepared for Atomics Intern., Canoga Park, Calif.
(AI-Trans-287) Avail: NTIS

Results of research are presented which support hypotheses concerning the physicochemical properties of In amalgams. Other work is reported on Hg, In-Ga alloys, and Na-O batteries. NSA

N71-27488# United Kingdom Atomic Energy Authority, Harwell (England). Health Physics and Medical Div.
BEHAVIOUR IN THE ATMOSPHERE OF THE AEROSOL FROM A SODIUM FIRE
W. S. Clough and J. A. Garland 1970 14 p refs
(AERE-R-6480) Avail: AEC Depository Libraries

The chemical form and physical size of the particles or droplets formed when sodium is released into the atmosphere are modified by atmospheric oxygen, water vapor, and carbon dioxide. The chemical form under various conditions was predicted and the equilibrium droplet size for a given sodium compound was calculated as a function of sodium mass and relative humidity. The formation of sodium carbonate from sodium hydroxide droplets is controlled by liquid phase diffusion of reactants in the drop and probably occurs in times less than a few minutes. The formation of sodium bicarbonate from sodium carbonate droplets is much slower. At humidities below 95%, the final state is a particle of sodium carbonate, although droplets of hydroxide solution may be present for a time (1 minute or less). The appreciable changes in size consequent upon changes in relative humidity may lead to important changes in the residence time and deposition of the particles in the atmosphere. Author (NSA)

N71-27478# Sandia Corp., Albuquerque, N.Mex.
LOW TEMPERATURE REGIN SYSTEMS
Kenneth B. Wiechmann and Gilbert W. Brassell Dec. 1970 22 p

refs Sponsored by AEC
(SC-DR-70-421) Avail: NTIS

The chemistry of cure and correlation of polymer structure to the low temperature mechanical properties of some epoxy/urethane formulations are described. The primary curing reaction in these systems is the amine curative reacting with the urethane; the amine/epoxy reaction appears to be a secondary reaction. Low temperature torsion pendulum studies of mechanical damping of these formulations have shown that these materials undergo a suborder transition at −140 C, which is related to the crosslinking segment. This suborder transition causes marked changes in mechanical properties near this temperature. Author

N71-27598# Ballistic Research Labs., Aberdeen Proving Ground, Md.

CO2 CLUSTERING TO POSITIVE POTASSIUM ION

George E. Keller and Richard A. Beyer Feb. 1971 47 p refs
(AD-720997; BRL-R-1528) Avail: NTIS CSCL 7/4

A drift tube with mass-spectrometric analysis has been used to study the transport of K(+) through N2, Ar, and CO2. K(+).Ar was not observed. K(+).N2 was observed, but in quantities too small to interfere with a mobility determination of K(+) in N2. CO2 clustered readily to K(+). Author (GRA)

N71-27610# Air Force Office of Scientific Research, Arlington, Va.

THE 16th ANNUAL CHEMISTRY PROGRAM REVIEW FOR THE FISCAL YEAR 1970

L. D. Whipple Jan. 1971 240 p refs
(AD-721205; AFOSR-70-1540TR) Avail: NTIS CSCL 7/2

The review provides a record of research in progress together with illustrative achievements resulting from the basic research program of the Directorate of Chemical Sciences, AFOSR (AFSC). There are three main sections in the review. The first section presents various technical aspects of the program and their relationship to Air Force interests. This section includes papers on chemical instrumentation and techniques, chemical structure and properties, chemical energetics, and chemical synthesis and dynamics. The second section contains summaries of program statistics. The third section consists of factual summaries of each project completed during Fiscal Year 1970. Author (GRA)

N71-27663# United Kingdom Atomic Energy Authority, Risely (England).

SOLUBILITY OF CARBON IN SODIUM

G. Longson and A. W. Thorley May 1979 20 p refs
(TRG-Report-1906) Avail: AEC Depository Libraries

The solubility of carbon in sodium in the temperature range 600 to 950C may be expressed by the equation: log sol (ppM) = 7.20 − 5465/T K. From plots of carbon activity versus concentration, and from observations that oxygen did not effect carbon solubility, it is proposed that carbon dissolves in sodium as single atoms. Author (NSA)

N71-27712# Washington State Univ., Pullman. Dept. of Chemistry.

AN O 17 NUCLEAR MAGNETIC RESONANCE STUDY OF NICKEL(II)-ETHYLENE DIAMINE TETRAACETATE COMPLEXES IN AQUEOUS SOLUTION

Michael W. Grant, Harold W. Dodgen, and John P. Hunt 1970 14 p refs
(Contract AT(45-1)-2221)
(RLO-2221-T-4-5) Avail: NTIS

At pH = 2 the nickel(II)-ethylenediaminetetraacetate (EDTA) complex appears to exist as Ni(H2O)HEDTA(−) with one (protonated) acetate arm replaced by a water molecule. Kinetic parameters for water exchange with this species are given. The scalar coupling constant A/h for the Ni-O interaction is (2.3 + or − 0.1) × 10 to the 7th power Hz. At pH = 6−7 evidence for significant amounts of an aquo-EDTA complex was found. It was concluded that a six-coordinate species, Ni(H2O)(EDTA)(2−), with one unprotonated acetate arm off, best explains the observations. The scalar coupling constant A/h is (2.6 + or − 0.2) × 10 to the 7th power Hz. Effects of substitution on water lability are discussed as well as structural implications. The nickel (II)-ethylene-diaminedisuccinic acid (EDDS) complex also appears to have a small percentage of aquo form present at high pH. Author

N71-27720# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.

ALIGNMENT OF NEMATIC LIQUID CRYSTALS

James D. Lee and A. Cemal Eringen Oct. 1970 25 p refs
(Contract N00014-67-A-0151-0004)
(AD-721107; TR-20; AMS-958) Avail: NTIS CSCL 7/4

Two problems in the theory of nematic liquid crystals are formulated. One is concerned with the change of orientation due to magnetic field and the other with shear flow. The solutions of the governing differential equations explain the physical phenomena which have been observed experimentally, namely, the alignment of nematic liquid crystals with the magnetic field and with shear flow. In fact, it is shown that these two phenomena are closely related to each other. Author (GRA)

N71-27763# Reactor Centrum Nederland, Petten.

ACCURATE AND PRECISE TITRIMETRIC ANALYSIS OF URANIUM IN NUCLEAR FUELS

A. Tolk, W. A. Lingerak, and T. A. Verheul-Klompmaker Sep. 1970 11 p refs
(RCN-126) Avail: AEC Depository Libraries

For the accurate and precise titrimetric determination of uranium in nuclear fuels, the material is dissolved in orthophosphoric and nitric acids. The nitric acid is fumed off, and the U(6) present is analyzed reductometrically in a CO2 atmosphere with iron (2) ammonium sulfate. For U3O8 test sample aliquots of 800 and 80 mg, coefficients of variation of 0.012 and 0.11%, respectively, were measured. Author (NSA)

N71-27982# Germantown Labs., Inc., Philadelphia, Pa.

A SIMPLE EMPIRICAL RELATIONSHIP BETWEEN THE COMPRESSIBILITY AND TEMPERATURE OF IDEAL LIQUIDS, COVERING THE RANGE FROM MELTING POINT TO CRITICAL POINT, AND ITS APPLICATION TO MERCURY

A. V. Grosse 20 Dec. 1970 13 p refs
(Contract AT(30-1)-4176)
(NYO-4176-6; GL-1970-15) Avail: NTIS

Simple empirical relationships for liquid argon, krypton, xenon, and mercury are briefly discussed. The relation for the liquefied gases is between the reciprocal reduced adiabatic compressibility, the adiabatic bulk modulus, and the reduced temperature. Further study showed that one hyperbola could represent all three liquids, and it is similar to the equilateral hyperbolas describing the relation between a metal's electeical conductivity and its reduced temperature. The fit of experimental data for each of the four liquids to the empirical curves is discussed. N.E.N.

07 COMMUNICATIONS

Includes communications equipment and techniques, noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N71-26816# General Instrument Corp., Hicksville, N.Y. Electronic Systems Div.

RADAR SET AN/PPS-17 (XN-1) FAILURE FREE DEVELOPMENT PROGRAM Interim Development Report, 1 Jan.–26 Feb. 1971

1971 22 p

(Contract N00039-70-C-3501)

(AD-719912; ESD-1158-IR-12; ESD-1158-IR-13) Avail: NTIS CSCL 17/9

The report outlines accomplishments in performing confidance testing of the angular head, R/T assembly and various subcontracted subassemblies. Problems uncovered and solutions are discussed in detail. Other areas covered in this report are: Progress made on fabrication and assembly of 20 production AN/PPS-17 systems; conference with NAVELEX representative on 1 and 2 February 1971; reliability effort and submission of updated reliability prediction.

Author (GRA)

N71-26889# New Hampshire Univ., Durham. Antenna Systems Lab.

ANTENNA RATIO CALIBRATION FOR THE AFCRL METEOR RADAR USING OV1-17

Albert D. Frost and Ronald R. Clark 17 Aug. 1970 33 p refs

(Contract F19628-67-C-0230)

(AD-721195; AFCRL-71-0063; SR-2) Avail: NTIS CSCL 17/9

Experiments using a beacon transmitter at 36.8 MHz, including in the scientific payload of satellite OV1-17 to test and calibrate direction-finding techniques associated with the University of New Hampshire/AFCRL Meteor Trails Radar are reported. Comparison is made between a passive system which seeks to determine source elevation by examination of the ratio of signals received on two dipoles, lambda/2 and lambda/4 above a ground screen and a phase sequence interferometer in which the pattern nulls are actively scanned in azimuth and elevation.

Author (GRA)

N71-26890# International Business Machines Corp., Owego, N.Y. Electronics Systems Center.

WAVELENGTH DIVISION MULTIPLEXING IN LIGHT INTERFACE TECHNOLOGY Final Technical Report, Aug. 1970–Jan. 1971

Daniel J. Stigliani, Jr., David W. Hanna, and Robert J. Lynch 18 Mar. 1971 78 p refs

(Contract N00014-71-C-0012)

(AD-721085; IBM-71-531-001) Avail: NTIS CSCL 20/6

The report describes the investigation and fabrication of a five channel wavelength division multiplex (WDM) optical communication link. The transmitter consists of five different wavelength Ga(1-x)Al(x)As light emitting diodes (LEDs) and the receiver consists of five narrowband photodiodes (PDs). The light is conducted from the transmitter to the receiver by a fiber optic bundle. Various techniques (dichroic filters, furcated fiber bundle, and LED and PD plane arrays) of coupling the light into and out of the fiber bundle are investigated. Measurements of receiver sensitivity, optical efficiency, and optical cross-coupling between channels were made. A theoretical analysis of the link optical efficiency and expected cross-coupling is performed and design information for future WDM optical links is established. It is also determined that fiber bundles which are classified as incoherent are, in general, quasi-coherent. It was necessary to incorporate optical mixing cylinders at the entrance and exit of the bundle to uniformly distribute the light throughout the cross-section.

Author (GRA)

N71-26941# Sandia Corp., Albuquerque, N.Mex. TM Development Div.

A COMPARISON OF CBW FM/FM AND DSB/FM TELEMETRY SYSTEMS

C. S. Johnson Dec. 1970 67 p ref

(SC-DR-70-686) Avail: NTIS

DSB/FM systems are a new method for multiplexing and transmitting shock, vibration, and acoustical data from airborne systems. The DSB/FM system is generally compared to the standard IRIG CBW FM/FM system whose subcarrier channel spectral occupancy is approximately the same as that of the DSB system when the subcarrier uses a modulation index of one. The experimental data and comparisons made in this paper are based on CBW and DSB systems that were tested under identical conditions. The type of data loading, random noise, is intended to simulate wideband data that the systems would commonly be transmitting in normal field usage. The two systems tested in this manner present a worst-case boundary for the performance with respect to the quality of data transmission and the signal-to-noise ratios of the systems. Conclusions are drawn from the comparison and the data are presented.

Author

N71-27029# Lausanne Univ. (Switzerland).

MARCUM FUNCTION Q(a,b) AND CALCULATION METHOD BY COMPUTER [FONCTION Q(a,b) DE MARCUM ET METHODE DE CALCUL PAR ORDINATEUR]

Frederic de Coulon and Murat Kunt 1969 13 p ref In FRENCH

Avail: NTIS

The Marcum function Q(a,b) appears in several problems of detection when it is linked with taking correct or incorrect decisions. A method is described to solve it by means of a recursive method.

ESRO

N71-27066* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

ANTENNA ARRAY PHASE QUADRATURE TRACKING SYSTEM Patent

Harold Dean Cubley, inventor (to NASA) Issued 2 Mar. 1971 6 p Filed 6 Dec. 1968 Cl. 343-100; Cl. 325-16; Cl. 325-23; Cl. 325-369; Cl. 343-117; Cl. 343-176; Int. Cl. G01s3/46

(NASA-Case-MSC-12205-1; US-Patent-3,568,197; US-Patent-Appl-SN-882577) Avail: US Patent Office CSCL 17B

The system input signals on two separate antenna elements in an antenna array are combined to form two processed signals with one such signal representing the absolute value of the sum of the two antenna signals and the other representing the absolute value of the difference of the signals. The two processed signals are time multiplexed through a radiofrequency switch operating at 10-millisecond intervals to form a single input signal to a receiver which in turn detects amplitude modulation in the multiplexed signal and forms an amplitude dependent signal to control a variable phase shifter circuit. The latter circuit automatically alters the relative phase between the two antenna signals whenever any amplitude modulation exists in the multiplex signal. Relative phase shift of the antenna signals stops when the absolute value of the two processed output signals are equal to each other which occurs only when the two antenna signals are in phase quadrature.

Official Gazette of the U.S. Patent Office

N71-27110# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).

INTRODUCTION OF NOISES INTO A SIMULATION SYSTEM [INTRODUCTION DE BRUITS DANS LA SIMULATION D'UN SYSTEME]

4 Jan. 1971 17 p In FRENCH

(LRBA-NT-3) Avail: NTIS

Deterministic and statistical methods are used to study the output of a system submitted to several error sources in which the errors are characterized by their autocorrelation function. In the statistical case a filter is used which will introduce a white noise. This method, valid for a stationary system is questionable for dynamic systems. It is shown that the autocorrelation function has the desired accuracy, but at infinity.

ESRO

N71-27156# Hawker Siddeley Dynamics, Ltd., Hatfield (England). Space Div.
DESIGN REPORT TO ESRO FOR A DESPIN ASSEMBLY
T. Rees comp. Oct. 1970 232 p refs
(Contract ESTEC-942-70-AA)
(HSD-TP-7213) Copyright. Avail: NTIS

A proposal is elaborated for the despin assembly of a satellite directional antenna. Attention is paid to the bearing assembly, its lubrication, and the electric motor drive. A manufacturing cost estimate is also given. ESRO

N71-27157# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. fuer Ionosphaerenphysik.
GEOMETRICAL AND IONOSPHERIC INFLUENCES ON RADIO WAVE PROPAGATION BETWEEN 0.2 AND 2 MHZ WITH REGARD TO LIFE BUOY ACQUISITION [GEOMETRISCHE UND IONOSPHAERISCHE EINFLUESSE AUF DIE FUNKWELLENAUSBREITUNG ZWISCHEN 0,2 UND 2 MHZ IM HINBLICK AUF DIE ORTUNG VON SEENOTBOJEN]
Wilhelm Elling Duesseldorf Deut. Ges. fuer Ortung und Navigation 1969 14 p refs In GERMAN Presented at the Intern. Navigation Meeting, Hamburg, 28–30 Oct. 1969
Avail: NTIS

The problem of acquisitioning salvage buoys emitting very high frequency radio waves transmitted both as ground waves and by ionospheric reflection is discussed. It appears that night time and higher frequencies have an adverse effect on acquisition. ESRO

N71-27158# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
DEFINITION STUDY OF AN ANTENNA DESPIN MECHANISM Final Report
Nov. 1970 79 p refs
(Contract ESTEC-1060/70/SL)
Avail: NTIS

A definition study of a directional antenna despin mechanism, for use on a communication satellite, is presented. Particular attention is paid to the bearing assembly, its lubrication, and the motor drive to be used for directing the antenna. ESRO

N71-27177# Signatron, Inc., Lexington, Mass.
ANALOG CODING Final Technical Report, 19 Aug. 1968–15 Aug. 1970
Julian J. Bussgang and Herbert Gish Griffiss AFB, N.Y. RADC Mar. 1971 108 p refs
(Contract F30602-69-C-0044)
(AD-721228; RADC-TR-71-46) Avail: NTIS CSCL 9/4

The report is concerned with a systematic approach to the development and understanding of nonlinear modulation techniques. Rate distortion theory is used as the basis of determining the potential improvement which is possible by efficient utilization of available bandwidth. It is shown that the performance of a typical communication link could be improved by orders of magnitude through proper modulator/demodulator design. The performance of modulation techniques are evaluated and are compared with applicable bounds. The technique of minimizing the upper bound on the distortion is applied to establish what is the optimum modulator within the class of a certain structure. Further investigation in this area is recommended. Results indicate that to achieve theoretically attainable performance, the modulator must not only be nonlinear but must also make efficient use of memory. Author (GRA)

N71-27178# Army Foreign Science and Technology Center, Charlottesville, Va.
A DEVICE FOR CONTINUOUS REGISTRY OF THE INTENSITY OF A METEOROLOGICAL RADIO SPACE ECHO [VSTROYSTVO DIYA NEPRERYVNOY REGISTRATSII INTENSIVNOSTI METEOROLOGICHESKOGO RADIOEKHO]
G. B. Brylev et al 18 Feb. 1971 13 p Transl. into ENGLISH of Russian report
(AD-721249; FSTC-HT-23-1111-70) Avail: NTIS CSCL 17/9

Recording reflected signals makes it possible to check amplitude changes; this can be used to investigate meteorological conditions. The strobed volume adapted from radar observations facilitate study of amplitude changes with time and in space for different degrees of spatial and temporal averaging. The authors go into detail in matters of construction, calibration and possible errors in their measurements. Author (GRA)

N71-27190# Army Foreign Science and Technology Center, Charlottesville, Va.
LIGHT PHASE RANGE FINDING AND MODULATION OF OPTICAL RADIATION [FAZOVAYA SVETODALNOMETRIYA I MODULYATSIYA OPTICHESKOGO IZLUCHENIYA]
I. I. Adrianova et al 24 Feb. 1971 28 p refs Transl. into ENGLISH from Optiko-Mekh. Prom. (Leningrad), no. 4, Apr. 1970
(AD-721253; FSTC-HT-23-062-71) Avail: NTIS CSCL 17/8

Soviet development of optical radar by the State Optical Institute, culminating in the worlds first range finder using propagation time of light, is discussed. The principles of this new branch of optical radar, known as light phase range finding, are examined in detail. The conclusion aims at obtaining greater effectiveness and efficiency through further development of pulse range finding. Author (GRA)

N71-27191* Sperry Rand Corp., Huntsville, Ala.
COLLAPSIBLE ANTENNA BOOM AND TRANSMISSION LINE Patent
Lawrence L. Rainwater, inventor (to NASA) Issued 9 Mar. 1971 5 p Filed 10 Feb. 1969 Cl. 333-96; Cl. 333-95; Cl. 174-28; Cl. 343-884; Int. Cl. H01p3/06; Int. Cl. H01p3/14; Int. Cl. H01q1/22 Sponsored by NASA
(NASA-Case-MFS-20068; US-Patent-3,569,875; US-Patent-Appl-SN-797795) Avail: US Patent Office CSCL 09E

A collapsible antenna boom and coaxial transmission line having an inflatable inner tube are described. The tubular outer casing is made of two sheets of thin sheet metal butted together and seam welded to form two protruding flanges at opposite sides of the casing. The inner tube, which provides considerable strength to the boom, has four compartments spaced around its outer circumference and a center compartment all interconnected by ports Four parallel transmission line inner conductors are all equally spaced around the inner wall of the center compartment. The outer casing serves as the outer transmission line conductor. The design of the tubular outer casing and the inflatable inner tube permits the boom to be folded and rolled on a reel when not in use. Official Gazette of the U.S. Patent Office

N71-27195# General Instrument Corp., Hicksville, N.Y. Electronic Systems Div.
RADAR SET AN/PPS-17(XN-1) FAILURE FREE DEVELOPMENT PROGRAM Interim Development Report, 1 Nov.–31 Dec. 1970
Walter Seidman and Al Zecca 31 Jul. 1970 11 p
(Contract N00039-70-C-3501)
(AD-719911; Rept-1158-IR-10; Rept-1158-IR-11) Avail: NTIS CSCL 17/9

Production is now in the process of completing the tripod assembly, machining first piece castings, and fabricating printed circuit boards. Author (GRA)

N71-27209# Naval Research Lab., Washington, D.C.
ON STATISTICAL MULTIMODE VLF FIELD STRENGTH PREDICTIONS Interim Report

Francis J. Kelly, F. J. Rhoads, and I. P. Hansen 23 Feb. 1971 15 p ref
(AD-720318; NRL-7239) Avail: NTIS CSCL 20/14

A method has been derived for predicting the time availability of vlf field strengths by using the earth ionosphere waveguide model. For the present calculations the ionospheric parameters Beta and h of Wait and Spies are considered to be independent random variables. The field strengths at various distances from the transmitter are calculated as dependent random variables. The results indicate that the statistical distribution of the received field strength will vary as a function of distance from the transmitter. Author (GRA)

N71-27233* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANTENNA ARRAY AT FOCAL PLANE OF REFLECTOR WITH COUPLING NETWORK FOR BEAM SWITCHING Patent
William Korvin and Milton K. Mills, inventors (to NASA) Issued 9 Mar. 1971 10 p Filed 29 Aug. 1968 Cl. 343-777; Cl. 343-779; Cl. 343-786; Cl. 343-840; Cl. 343-854; Int. Cl. H01q3/26; Int. Cl. H01q13/00
(NASA-Case-GSC-10220-1; US-Patent-3,569,976; US-Patent-Appl-SN-759256) Avail: US Patent Office CSCL 09E

An antenna system for steering plural beams from a secondary reflector is formed from a primary array of linear feed elements, which can be arranged in either a one- or two-dimensional configuration. By controlling which of the radiators are simultaneously excited with a switching matrix, the position of the primary beam is varied as a function of the axis of the reflector forming the secondary beam. Official Gazette of the U.S. Patent Office

N71-27292# Michigan Univ., Ann Arbor.
MEASUREMENT OF SPEECH INTELLIGIBILITY Final Report, Feb. 1966 – Jan. 1969
Wilson P. Tanner Apr. 1970 89 p refs
(Contract N00014-67-A-0181-0010)
(AD-720091) Avail: NTIS CSCL 17/2

A model of the speech recognition process was presented in an attempt to find adequate measures of intelligibility and intelligence. An experiment was designed to test the model and the validity of the measures. Four trained subjects responded to distorted speech samples from a message set containing twelve single words and from a message set containing thirty-six three-word sequences. The goal was to predict the scores which would be obtained on the sequences from the scores obtained on the single words. A posteriori predictions were attempted using percentage correct measures and measures derived from information theory and a priori predictions were made from the decision theory model proposed in the study. The results of these data support the information theory and decision theory model. Author (GRA)

N71-27310# Lehigh Univ., Bethlehem, Pa. Dept. of Electrical Engineering.
A CRITICAL STATISTIC FOR CHANNELS WITH MEMORY
B. D. Fritchman, J.-P. A. Adoul, and L. N. Kanal Mar. 1971 48 p refs Prepared in cooperation with Sherbrooke Univ., Quebec and Md. Univ., College Park
(Grant AF-AFOSR-1390-68)
(AD-720866; AFOSR-TR-71-0644) Avail: NTIS CSCL 9/4

The report describes a new descriptive statistic for channels with memory. Its utility is shown (a) in evaluating and comparing existing models for such channels, and (b) as a theoretical tool in defining the error-gap distribution characteristics of real channels. It is shown that certain kinds of real channel behavior cannot be adquately described by previously proposed models. An example of a better model is offered which includes many of the earlier models as special cases. Author (GRA)

N71-27313# Edgerton, Germeshausen and Grier, Inc., Bedford, Mass.
ON THE CALIBRATION, ACCURACY, AND EFFICIENCY OF OPTICAL RANGE FINDERS Final Report, Mar. – Jun. 1970
Sumner Ackerman 31 Jul. 1970 108 p refs
(Contract F19628-70-C-0200)
(AD-720855; EG/G-B-4248; AFCRL-71-0021) Avail: NTIS CSCL 17/8

A theory has been developed concerning the calibration, random errors, and efficiency of optical range finders as a function of signal energy; the magnitude of background noise is treated as a parameter. Efficiency is defined herein as the amount of information obtained on the location of the target within the transmitter-pulse period per range measurement trial per unit of signal energy used. Poisson and Bose – Einstein photoemission statistics were assumed. Experimental measurements are generally in good agreement with theoretical predictions. Author (GRA)

N71-27319 Texas A&M Univ., College Station.
MAXIMUM-LIKELIHOOD DETECTION OF UNIFORM CONVOLUTIONAL CODES
William Donald Gorman (Ph.D. Thesis) 1969 148 p
Avail: Univ. Microfilms Order No. 70-11541

An algebraic decoding algorithm for the maximum-likelihood detection of uniform convolutional codes is developed. Coded signals are assumed to be transmitted over a coherent pulse shift keyed (PSK) channel which is corrupted by additive white Gaussian noise. The probability of making a first decoding error was calculated for codes of one-half and one-fourth redundancy with the aid of an IBM 360 digital computer, by numerical integration of two and four-dimensional Gaussian density functions. For an information-bit-energy-to-noise-power-density ratio equal to 1.0, the error rate of the one-half redundancy code was found to be twice that of uncoded coherent PSK, while the error rate of the one-fourth redundancy code was about three and one-half times that of the uncoded case. Experimental results of the coded and uncoded cases are compared and found to show relationships similar to those calculated from theory. Dissert. Abstr.

N71-27341* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIDEO SIGNAL ENHANCEMENT SYSTEM WITH DYNAMIC RANGE COMPRESSION AND MODULATION INDEX EXPANSION Patent
Robert Y. Wong, inventor (to NASA) Issued 23 Feb. 1971 7 p Filed 7 Aug. 1969 Cl. 178-7.1; Cl. 178-7.3; Int. Cl. H04n5/14 Sponsored by NASA
(NASA-Case-NPO-10343; US-Patent-3,566,027; US-Patent-Appl-SN-750786) Avail: US Patent Office CSCL 09F

A video signal enhancement system is disclosed for enhancing the signal component representing the brightness of elements in a low contrast scene. Overall scene contrast is represented by a slowly varying dc component of an amplitude-modulated carrier frequency and the element brightness by one cycle of the carrier frequency. The system includes in addition to input/output and intermediate filters, an automatic signal range control circuit, which acts as a high pass filter to reduce the effect of the low frequency signal component. Official Gazette of the U.S. Patent Office

N71-27381# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Electrophysics.
AN EXPERIMENTAL STUDY OF RADIOWAVE PROPAGATION IN DISSIPATIVE ENVIRONMENTS Semiannual Report, 16 Jun. – 15 Dec. 1969
Theodor Tamir Jan. 1970 11 p refs
(Contract DAAB07-68-C-0222)
(AD-720998; PIBEP-70-005; ECOM-0222-1-JAN-70) Avail: NTIS CSCL 17/2

Preliminary work is described on the design and operation of an X-band measurement set-up for simulating radio-wave

propagation in dissipative environments. Research activities within the past period include basic design considerations and, in particular, the tentative utilization and measurement of an aluminum-coated mylar film to be used as a major component in the projected measuring instrumentation. Author (GRA)

N71-27356# Institute for Telecommunication Sciences, Boulder, Colo.

SPECTRAL CHARACTERISTICS OF RADAR TARGET RETURNS IN CLUTTER

Herman V. Cottony and Alvin C. Wilson (NBS, Boulder) 31 Dec. 1970 44 p refs

(Contract PRO-Y-70-818)

(AD-720851; AFCRL-71-0017; SR-3-5) Avail: NTIS CSCL 17/9

The results of further investigation into the possibility of resolving radar targets in clutter, using spectral approach, are described. Characteristics of back-scatter returns by ground-clutter scatterers consisting of seven non-resonant scatterers are examined in the frequency domain. It is seen that, when the scatterers are of equal magnitude and are equally spaced in range, the returns, in the frequency domain, are characterized by lobes of relatively high amplitude separated by gaps in frequency spectrum where the amplitude is relatively low. A mathematical analogy to the radiation pattern of an array antenna is pointed out. Three quasi-random ground-clutter models were designed, using tables of random digits. The returns from these models, measured in the frequency domain, were recorded and compared witd conditions and the conditions found at the range, the agreement is found satisfactory. Three cases of backscatter radar models consisting of one or two non-resonant target scatterers in quasi-random clutter models were investigated. As a result, it appears that the search for hidden target scatter may be simplified if a searching pulse, with time delay varying linearly with time, is injected into the system. Author (GRA)

N71-27357# Washington Univ., Seattle. Dept. of Electrical Engineering.

TEMPORAL FREQUENCY SPECTRA OF MULTIFREQUENCY WAVES IN A TURBULENT ATMOSPHERE

Akira Ishimaru Nov. 1970 47 p refs

(Contract F19628-69-C-0123)

(AD-720869; TR-141; AFCRL-70-0696; SR-2) Avail: NTIS CSCL 20/14

General formulations for temporal frequency spectra of the fluctuations of plane, spherical and beam waves operating at two frequencies are given based on weak turbulence and frozen-in assumptions. The cross spectra and the coherence are obtained for the amplitude at two frequencies, the phase at two frequencies, and the amplitude at one frequency and the phase at another frequency. The results are examined in detail for a plane wave case. For the spectrum of the index of refraction Rappa to the -nth power in the inertial subrange, the amplitude spectrum behaves as K to the power((5-n)/2) for omega approaches zero and (k squared)(omega to the power (1-n)) for omega approaches infinity. The phase spectrum for omega approaches zero and for omega approaches infinity behaves as (k squared)(omega to the power (1-n)) with different constants. These results agree well with the experimental work of Janes, Thompson, Smith, and Kirkpatrick at 9.6 GHz and 34.5 GHz, and explains the ratio of the spectra at two frequencies. Also noted is the experimental slope of -2.6 as omega approaches infinity which may be compared with 1 - n = -2.66 using the Kolmogorov spectrum of n = 11/3. Author (GRA)

N71-27424# New Hampshire Univ., Durham. Antenna Systems Lab.

SATELLITE VERIFICATION OF AN INTERFEROMETER DIRECTION FINDER FOR METEOR RADAR ECHOES

Ronald R. Clark, Filson H. Glanz, and Albert D. Frost 18 Aug. 1970 51 p refs

(Contract F19628-67-C-0230)

(AD-720865; AFCRL-70-0697; SR-3) Avail: NTIS CSCL 17/3

A phase-sequenced interferometer subsystem is described which has been shown to provide accurate determination of the azimuth and elevation of short lived radar targets. This system is part of a Meteor Radar System used to study upper atmospheric winds. The interferometer sybsystem provides the angle information in the form of a train of digital pulses which are recorded on magnetic tape as part of the system output. Satellite verification has been used to determine the accuracy of the subsystem, which is calibrated by a straight-forward procedure on the ground. Results of this verification are discussed and modifications to the present system are suggested. Author (GRA)

N71-27603# Australian Post Office Research Labs., Melbourne.

CIRCULAR WAVEGUIDE AS A HIGH CAPACITY COMMUNICATION MEDIUM

G. P. Kidd May 1970 51 p refs

(Rept-8494) Avail: NTIS

The theoretical properties of overmoded circular waveguide which make it potentially useful as a high-capacity transmission medium, and some of the consequent disadvantages and means of overcoming them, are considered. The characteristics of some experimental waveguides and systems are summarised. Recommendations for a research program to study outstanding problems are given. Author

N71-27670*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THEORY OF THE 24.6/73.6 MHz CW PROPAGATION EXPERIMENT

John E. Jackson Apr. 1971 28 p refs

(NASA-TM-X-65552; X-625-71-154) Avail: NTIS CSCL 17B

A theoretical treatment is presented of the two-frequency (24.5/73.6 MHz) rocket-to-ground CW propagation experiment for in situ electron density measurements. The propagation experiment measures the difference between two phase path integrals, and the local density is calculated from the rate of change of this difference. The basic relationships are derived directly from the concept of equivalent vertical electron content. This leads to formulas in which temporal and spatial ionospheric variations appear in explicit form. These variations give rise to errors, which depend upon both fluctuation rates and geometric factors associated with the rocket trajectory. Examples of these errors are given for typical experimental conditions. Author

N71-27695*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

STABILITY OF A STEADY, LARGE AMPLITUDE WHISTLER WAVE

P. J. Palmadesso and G. Schmidt May 1970 28 p refs Submitted for publication

(NASA-TM-X-65572; X-640-71-208) Avail: NTIS CSCL 20N

The behavior of weak electrostatic waves in a collisionless magnetoplasma supporting a steady large amplitude whistler wave was studied. All waves are assumed to propagate parallel to a uniform background magnetic field. In the presence of the whistler wave field each particle executes an oscillary motion parallel to the background magnetic field. This oscillation causes the Landau resonance to be replaced by a series of new resonances between particles and the electrostatic modes. A distribution function for the perturbed plasma is constructed by solving the Vlasov equation, linearized in the electrostatic wave amplitudes. A dispersion relation is obtained and solved approximately for the growth/damping rate of the perturbations. Growing electrostatic modes are found to be approximately uncoupled. Trapped particles have a strong influence on the stability of the system. Author

N71-27721# Naval Weapons Lab., Dahlgren, Va.
THE EFFECT ON OBSERVATIONAL ACCURACY OF INCREASING THE DOPPLER COUNT
E. Joyce Greeley Mar. 1971 11 p
(AD-721070; NWL-TR-2550) Avail: NTIS CSCL 17/7

The purpose of this study was to investigate a proposed method of decreasing the random error of observation for a Doppler observation made during a satellite pass. The study shows that doubling the measurement interval does significantly reduce the noise level. Author (GRA)

N71-27757# Institute for Telecommunication Sciences, Boulder, Colo.
EVALUATION OF THE SURFACE ELECTROMAGNETIC FIELDS FOR A BURIED MAGNETIC DIPOLE SOURCE Interim Report
James R. Wait and Kenneth P. Spies 5 Feb. 1971 62 p refs
(Contract PRO-Y-71-872)
(AD-721196; AFCRL-71-0090; SR-2; Rept-910-9101466) Avail: NTIS CSCL 9/5

An analysis and numerical results are presented for the surface fields produced by an oscillating magnetic dipole buried in a stratified earth. The results have application to communication from and direction-finding to a buried source. Author (GRA)

N71-27786*# Linkabit Corp., San Diego, Calif.
CODING SYSTEMS STUDY FOR HIGH DATA RATE TELEMETRY LINKS
K. S. Gilhausen, J. A. Heller, I. M. Jacobs, and A. J. Viterbi Jan. 1971 240 p refs
(Contract NAS2-6024)
(NASA-CR-114278) Avail: NTIS CSCL 09F

The results are presented of a study of coding systems for high data rate links with emphasis on convolutional codes. The bit error rate, in the 10 to the minus 3rd to 10 to the minus 8th power range, vs. E sub b/N sub 0 performance of many coding system configurations was studied, through simulation and analytical techniques. Special attention was paid to the sensitivity of performance to decoder parameters which affected complexity and cost significantly including code constraint length; code rate (bandwidth expansion); data rate; speed factor and buffer size (sequential decoding); path memory length, metric representation, and decision output selection (Viterbi decoding); and receiver quantization. A technique for obtaining and maintaining node synchronization and resolving phase ambiguities was devised and analyzed. Simulation indicated that performance is more than adequate for the systems considered. Author

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics

N71-27018*# Computer Sciences Corp., Huntsville, Ala. Aerospace Systems Center.
SYSTEM CONFIGURATION AND EXECUTIVE REQUIREMENTS SPECIFICATIONS FOR REUSABLE SHUTTLE AND SPACE STATION/BASE
J. R. Kennedy, R. T. Curran, W. S. Fitzpatrick, and J. M. Johnson Washington NASA May 1971 173 p refs
(Contract NAS8-24930)
(NASA-CR-1820; M534) Avail: NTIS CSCL 09B

Conceptual hardware configuration aspects that directly influence the respective executive systems are delineated. Performance requirements are defined which constrain or impel system software to a specific configuration. Functional requirements are derived for each respective vehicle's executive system. Executive design requirements comprising preliminary guidelines, objectives, and standards for system software functional design are established. The software modules necessary for effective operation of intricate space shuttle and station/base computational complexes are defined. Author

N71-27057* National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
RATE AUGMENTED DIGITAL TO ANALOG CONVERTER Patent
Sheldon Kopelson, inventor (to NASA) Issued 6 Apr. 1971 9 p Filed 24 Oct. 1968 Cl. 340-347DA; Cl. 235-151.11; Cl. 318-20.105; Int. Cl. H03k13/02
(NASA-Case-XLA-07828; US-Patent-3,573,797; US-Patent-Appl-SN-770209) Avail: US Patent Office CSCL 09B

A rate augmented digital-to-analog converter for computed time-dependent data is described. The converter produces a smooth continuous function by digitally incrementing functions samples at a rate proportion to a predicted functional change over each sample interval. The result is continuously converted to an analog voltage. The conversion produces an output which is, in effect, the sum of a linear ramp and the function sample. The converter input data are the computed sample and the change which is predicted by the solution of an nth-order extrapolation formula. The computer providing the function change information to the converter also solves the nth-order extrapolation formula.
Official Gazette of the U.S. Patent Office

N71-27134# Royal Inst. of Tech., Stockholm (Sweden). Div. of Electron Physics.
CMPLOT: A SET OF FORTRAN SUBROUTINES FOR PLOTTING OF GRAPHS AND DIAGRAMS USING THE CALCOMP 835 CRT PLOTTER
M. Sedlacek Apr. 1971 49 p
(TRITA-EPP-71-03) Avail: NTIS

CMPLOT consists of a set of interdependent FORTRAN subroutines designed for use with the 835 CRT CALCOMP plotter. The set produces graphs and diagrams consisting of coordinate system with divisions, scales and labels, title and other texts, lines, symbols, points, arrows, annotation lines etc. All subroutines of the CMPLOT set are written in FORTRAN 4 language and incorporate basic CALCOMP software consisting of CALCMP, NUMBER and SYMBOL routines. The set allows the user a flexible format for the input data and offers different options. If possible, the set tries to correct obvious errors and resolve the contradictions which may arise during the execution. Depending on the specified function to be performed the set is logically tied together by the user's master program. The CMPLOT set requires approximately 18,000 to 35,000 bytes of core storage for execution, depending on the included subroutines. Author (ESRO)

N71-27210* Applied Magnetics Corp., Goleta, Calif.
MAGNETIC RECORDING HEAD AND METHOD OF MAKING SAME Patent
James D. Kern and Valdimar W. Vodicka, inventors (to NASA) Issued 23 Feb. 1971 4 p Filed 26 Sep. 1968 Cl. 179-100.2; Cl. 29-603; Cl. 340-174.1; Int. Cl. G11b5/22; Int. Cl. G11b5/42 Sponsored by NASA
(NASA-Case-GSC-10097-1; US-Patent-3,566,045; US-Patent-Appl-SN-762957) Avail: US Patent Office CSCL 14C

A magnetic recording head with long life, composed of a ferrite core coated by a thin film of Alfesil is described for use in unattended recorders. Alfesil, a patented alloy of silicon, aluminum, and iron is coated on the ferrite core by plasma arc sputtering. F.O.S.

N71-27255* Borg-Warner Corp., Chicago, Ill.
DATA TRANSFER SYSTEM Patent

John E. Coolidge and John F. Kinkel, inventors (to NASA) Issued 16 Mar. 1971 11 p Filed 3 Jun. 1966 Cl. 340-172.5; Cl. 179-100.2; Cl. 340-146.1; Int. Cl. G06f3/00; Int. Cl. G11b5/00 Sponsored by NASA
(NASA-Case-NPO-12107; US-Patent-3,571,801; US-Patent-Appl-SN-555189) Avail: US Patent Office CSCL 09D

A data acquisition system is described which effects readout by clocking data from a tape into a storage register under control of a tape shift register. Data is clocked out of the data storage register by a clock shift register. A system clock drives a shift register and a divide by 10 circuit which both regulates the translation of the data clocked out of the storage register from a parallel to a precise serial format, and also drives the clock shift register. Output signals from the tape shift register and from the clock shift register drive a digital servocontrol circuit to regulate the speed of the motor which drives the tape transport, in order to insure that the data storage register neither overflows nor runs dry. Official Gazette of the U.S. Patent Office

N71-27298# Lyon Univ. (France). Inst. de Physique Nucleaire.
USE OF THE CAE 90 10 COMPUTER WITH THE LYON SYNCHROCYLOTRON. DEVELOPMENT OF A SYSTEM FOR ACQUIRING DATA AND IDENTIFYING PARTICLES [CONNEXION D'UN ORDINATEUR CAE 90 10 AU SYNCHRO-CYCLOTRON DE LYON, REALISATION D'UN ENSEMBLE D'ACQUISITION DE DONNEES ET D'IDENTIFICATION DE PARTICULES]
Marc Rebouillat (Ph.D. Thesis) Jun. 1970 74 p refs In FRENCH
(LYCEN-7049) Avail: AEC Depository Libraries

A multichannel input data acquisition assembly capable of identifying particles on two channels was studied. A single converter with a multiplexed input was used, in this way, the problems due to differences between converter response curves (converter slope and linearity) were avoided. The equipment developed presented to the computer a normal peripheral unit, in spite of the random manner in which the information was received. The Goulding system was retained to identify the particles. The path R of a particle of energy E is given by the empirical formula $R = a \times E$ to the bth power (a is a constant characteristic of the type of particle considered and b lies between 1.7 and 1.8). The energy loss and the final energy were measured. The information was digitized during the data acquisition sequence and the identifications parameter was subsequently obtained in two operations. The CAE 90 10 computer was fed with information received from a small auxiliary computer. Author (NSA)

N71-27362# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii SSSR. Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
PROGRAM OF CONNECTION OF THE MEASURING MICROSCOPES PUOS WITH COMPUTER MINSK-2
V. V. Ammosov, P. A. Gorichev, E. V. Teplov, and O. A. Shmelev 1969 24 p refs In RUSSIAN; ENGLISH summary
(IFVE-SPK-69-53) Avail: AEC Depository Libraries

A program for the computer Minsk-2, that provides a connection of 4 measuring microscopes PUOS with Minsk-2, is described. The program allows in a real time scale: 1) to control the sequence of measuring the bubble chamber pictures, 2) to detect various errors of the operators, as well as of the measuring system PUOS, and 3) to give a convenient representation (on the tape) of the measurement results. The program has been adjusted and tested at the Institute for High Energy Physics. NSA

N71-27722*# RAND Corp., Santa Monica, Calif.
EXPERIENCE WITH THE EXTENDABLE COMPUTER SYSTEM SIMULATOR
D. W. Kosy Dec. 1970 37 p refs
(Contracts NAS12-2144; F44620-67-C-0045)
(NASA-CR-118868; R-560-NASA/PR) Avail: NTIS CSCL 09B

Experience with the Extendable Computer System Simulator (ECSS), a special-purpose language for computer systems modeling, is discussed. Its strengths and weaknesses are outlined and some general principles are offered for improving the language with respect to user capability and convenience. The material is intended to be of interest to potential users of ECSS and to other designers of computer system modeling languages. Author

N71-27733# Bradford Computer and Systems, Inc., New York.
CONPLOT 2: A CONTOUR GENERATING PROGRAM Final Report
Bernard Fleshel Feb. 1971 103 p refs
(Contract DAAK02-69-C-0487)
(AD-721018; ETL-CR-71-1) Avail: NTIS CSCL 8/2

A contour generating system (CONPLOT II) is described whose input is a UNAMACE created magnetic tape. CONPLOT II is an improved and expanded version of CONPLOT I. Output of this sytem is a large cartographic quality contour map which can be combined to form still larger maps. This contour map includes (a) Universal Transverse Mercator Grin, (b) variable contour levels, (c) multiply labelled and broadened index contours, (d) depression indications, and (e) a variable output plotting scale. The following data handling techniques are used: (a) parallel processing, (b) random access, (c) binary searching, and (d) binary sorting. The internal processing of the input data includes (a) redundant data elimination, (b) noise elimination and data smoothing by either an Area Smoothing Algorithm or a Least Squares Smoothing Algorithm, (c) a contour smoothing algorithm, (d) fitting of resultant contours to streams to insure natural appearing intersections, (e) fitting of resultant contours to roads to achieve right angle road/contour crossings, and (f) automatic mosaicking of multiple models into a single large plotted map. Author (GRA)

N71-27734# California Univ., Livermore. Lawrence Radiation Lab.
WEAPONS EFFECT DISPLAY SYSTEM (WEDS MOD 2): PROMPT EFFECTS COMPUTER PROGRAM, VOLUME 6
Paul Franklin Dec. 1970 346 p Sponsored by AEC
(UCRL-50892-Vol-6) Avail: NTIS

The prompt effects computer program that has been developed by Lawrence Radiation Laboratory for WEDS MOD 2 is described. The program organization, data, procedures for changing the program, and a complete listing of all prompt effects software details are given. Author (NSA)

N71-27782*# Logicon, Inc., San Pedro, Calif.
ADVANCED SOFTWARE TECHNIQUES FOR SPACE SHUTTLE DATA MANAGEMENT SYSTEMS Final Report
Raymond J. Rubey, Wayne A. Ganzel, Michael D. Richter, and Steven A. Vere 26 Feb. 1971 203 p
(Contract NAS9-11225)
(NASA-CR-115032; CS-7107-R0216; MSC-02553) Avail: NTIS CSCL 09D

A hardware/software study of the space shuttle data management system is described. An analysis of the overall space shuttle objectives, mission requirements, and baseline hardware configurations is outlined which determined the nature and magnitude of the computational functions that the data management system will be called upon to perform. Tradeoff studies investigated the software advantages and disadvantages of alternative computer hardware configurations and architectures; single-computer (or simplex), multicomputer, and multiprocessor configurations were examined, together with detailed architectural features. Support hardware/software studies which investigated means of facilitating flight software development are summarized including high-order languages in which the flight software might be coded, and simulations and other analytic tools that might be used in verifying its correctness. Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N71-26842# Naval Research Lab., Orlando, Fla. Underwater Sound Reference Div.

HIGH PRESSURE PIEZOELECTRIC CERAMIC HYDROPHONE FOR INFRASONIC AND AUDIO FREQUENCIES USRD TYPE H48 Interim Report

Larry E. Ivey 15 Mar. 1971 13 p refs

(AD-721069; NRL-7260) Avail: NTIS CSCL 20/1

A pressure-sensitive reference hydrophone for the frequency range 0.3 Hz to 20 kHz at hydrostatic pressure to 68.9 megapascals (10,000 psi) and temperature from 0 to 30C has been developed. The nominal open-circuit crystal sensitivity of the hydrophone is -199 plus or minus 1 dB re 1 V/micropascals from 1 Hz to 20 kHz; the output of the lead zirconate-titanate spherical element is increased by a transistorized, 10-dB-gain preamplifier. A novel cable gland improves the high-pressure reliability of the hydrophone. Author (GRA)

N71-26897# Harry Diamond Labs., Washington, D.C.

A QUALITATIVE SYNOPSIS AND COMPARATIVE ANALYSIS OF MAJOR MICROELECTRONIC PRODUCTION TECHNOLOGIES

William L. Muckelroy Oct. 1970 37 p refs

(AD-721279; HDL-TM-70-22) Avail: NTIS CSCL 9/5

A synopsis of the major microelectronic production technologies is presented. The details of making monolithic integrated circuits and thin- and thick-film circuits are explored with comments on the equipment and materials used as well as the size of the products and various details of the circuits. In particular, the discourse in hybrid thick-film technology comments on the reasons for the use of the numerous materials in the process and the limitations as well as the advantages of the process. The structure of the thick-film resistor and the sintering furnace is described. The paper attempts to provide those involved in the designing of circuits for eventual engineering into hybrids some understanding of the processes available, their limitations, and advantages. The paper is structured to provide the design engineer with a qualified concept of hybrid manufacture to enable him to design his circuit to use a particular technology or choose the most suitable one for the job. Author (GRA)

N71-26898# Naval Postgraduate School, Monterey, Calif.

A STUDY OF BROADBAND HOT-CARRIER DIODE MIXERS

Ersin Gueler (M.S. Thesis) Dec. 1970 48 p refs

(AD-721244) Avail: NTIS CSCL 9/5

A theory is derived for single diode, single-balanced, and double-balanced mixers. An interfering signal is assumed to be present in order to analyze intermodulation and cross-modulation distortions. Measurements are made in the 50 - 200 MHz range and close agreement with the theory is found for conversion loss. Disagreement in RF and LO isolations is attributed to stray capacitances. It is also shown that circuit-board and transformer design greatly affects performance of a mixer. A comparison of the single diode, single-balanced, and double-balanced mixers is given and it is indicated that the double-balanced mixer is superior. Author (GRA)

N71-26899# Systems Science and Software, La Jolla, Calif.

THE WAFER AND DIFFUSION LOT DEPENDENCE OF SURFACE EFFECTS RESULTING FROM IONIZING RADIATION

David J. Albert Jul. 1970 58 p refs

(Contract DASA01-68-C-0161)

(AD-721096; Rept-3SR-371; DASA-2542) Avail: NTIS CSCL 9/1

An investigation of the wafer and diffusion lot dependence of surface effects resulting from ionizing radiation was conducted by irradiating samples of transistors. The transistors were selected by the wafer and diffusion lot from which they were produced. Both NPN and PNP transistors were irradiated. In the NPN transistors, which sustained large amounts of surface damage, there was statistically significant dependence of the surface damage on the diffusion lot. With the PNPs which were not effected to the same extent as the NPNs the dependence on the wafer or diffusion lot was not observed to be significant. No mavericks were noted in the experiment and further work is needed to determine the wafer or diffusion lot dependence of mavericks. Author (GRA)

N71-26942# Sandia Corp., Albuquerque, N.Mex. Unit Development Div.

SELECTING A TRANSFORMER CORE MATERIAL FOR A HIGH INDUCTION PULSED APPLICATION

A. A. Riedel Oct. 1970 20 p refs

(SC-DR-70-736) Avail: NTIS

Supermendur and silectron steel cores were evaluated for use in a high-voltage pulse application where the entire pulse transformer is encapsulated with glass microballoon-filled epoxy. The results of the study are described and the reasons are given for choosing silectron steel. Author

N71-26965# Bendix Corp., Kansas City, Mo.

STATE OF CURE OF PRINTED CIRCUIT BOARDS Final Report

J. W. Steele and K. C. Atkinson Jan. 1971 21 p

(Contract AT(29-1)-613)

(BDX-613-233) Avail: NTIS

Epoxy systems used in printed circuit board fabrication, represented by commercial samples from seven different manufacturers, were analyzed to determine degree of cure of resin constituents. The use of a thermomechanical device was evaluated and shows promise as a screening tool for determining the degree of cure of epoxy-glass laminates. Data from chemical analysis of unreacted epoxy and thermomechanical analysis show one of the seven materials evaluated to be apparently fully cured and one material to be significantly undercured. Author

N71-27001* Weston Instruments, Inc., College Park, Md. EMR Div.

ELECTRONICALLY RESETTABLE FUSE Patent

Roland E. Genter, inventor (to NASA) Issued 23 Mar. 1971 5 p Filed 29 May 1969 Cl. 317-9; Cl. 317-33; Int. Cl. H02h3/08; Int. Cl. H02h7/26 Sponsored by NASA

(NASA-Case-XGS-11177; US-Patent-3,571,656; US-Patent-Appl-SN-828921) Avail: US Patent Office CSCL 09A

An electronically resettable fuse with a saturable core current sensing transformer having two outside legs and a center leg is described. An oscillator is connected to balanced oscillator windings wound about the outside legs so as to produce an AC flux which saturates the outside magnetic path at waveform peak points. A DC current whose magnitude is to be sensed is passed through a control winding wound about the center leg, and produces a DC flux in the center leg which completes its loop through the two outside legs, only during intervals when the outside path is unsaturated. This completion occurs twice per cycle and is sensed by a sense winding also wound about the center leg. When the current in the control winding surpasses a bias level, the induced DC flux direction reverses and a 180 deg phase shift across the sense winding occurs. This phase reversal is sensed by a phase detector and utilized to open relay contacts connected to the

control winding. External means for resetting the relay from a remote location are also provided.
Official Gazette of the U.S. Patent Office

N71-27016* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESETTABLE MONOSTABLE PULSE GENERATOR Patent
Norman M. Garrahan, inventor (to NASA) Issued 9 Mar. 1971 7 p Filed 30 Aug. 1968 Cl. 307-273; Cl. 307-234; Cl. 307-246; Cl. 328-120; Cl. 330-30; Int. Cl. H03k3/284
(NASA-Case-GSC-11139; US-Patent-3,569,744; US-Patent-Appl-SN-756511) Avail: US Patent Office CSCL 09E

A resettable monostable pulse generator including a charge rundown-timing circuit is described. The charge rundown-timing circuit includes a capacitor that is charged to a peak value by a random pulse from a constant amplitude pulse source. After being charged, the capacitor immediately starts to discharge toward zero. In addition, an output pulse generator starts to generate an output pulse as soon as the capacitor is charged to its peak value and continues to generate the output pulse until the charge drops to a predetermined level. If a second pulse from the constant amplitude pulse source occurs during this rundown period, the capacitor is again charged to its peak value. This reset pulse prevents termination of the output pulse and recycles the termination time of the output pulse (pulse width) to be measured from the inception of the last reset pulse. Official Gazette of the U.S. Patent Office

N71-27053* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
VOLTAGE REGULATOR Patent
Sherwood Thaler, inventor (to NASA) Issued 23 Mar. 1971 5 p Filed 13 Oct. 1969 Cl. 323-48; Cl. 323-60; Int. Cl. H01f19/00; Int. Cl. H01f29/00
(NASA-Case-ERC-10113; US-Patent-3,571,699; US-Patent-Appl-SN-865811) Avail: US Patent Office CSCL 09E

Voltage regulators designed for connection in series with an alternating current source and a load and employing a three-leg, two-window transformer are described. Secondary windings on the two outer transformer core legs are interconnected to form a pair of secondary winding systems and the systems are interconnected via a variable resistance. Voltage regulation is achieved by varying the flux distribution in the transformer core by employing variable resistance to distribute the load current between the winding systems. Official Gazette of the U.S. Patent Office

N71-27205# Avco Corp., Wilmington, Mass. Systems Div.
MICROWAVE BREAKDOWN PREDICTIONS FOR A RECTANGULAR APERTURE ANTENNA INCLUDING LATERAL DIFFUSION
Jerrold M. Yos 18 Feb. 1971 19 p refs
(Contract F19628-69-C-0121)
(AD-721203; AVSD-0144-71-CR; AFCRL-71-0120; SR-4) Avail: NTIS CSCL 20/14

An improved approximation for the microwave breakdown characteristics of a rectangular aperture antenna in an infinite ground plane was obtained using the variational method of Mayhan and Fante. This approximation is a generalization of that given previously by Mayhan and Fante, and reduces exactly to the latter result in the limit when diffusion across the aperture is negligible. The new approximation is compared with previous theory and with experimental data. Author (GRA)

N71-27229# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ANALYSIS OF DIFFERENTIAL LINE LENGTH DIPLEXERS AND LONG STUB FILTERS
Joseph C. Lee 18 Feb. 1971 29 p refs
(Contract F19628-70-C-0230)
(AD-721231; ESD-TR-71-17; TN-1971-13) Avail: NTIS CSCL 9/1

Formulas for calculating the appropriate waveguide width for perfect performance at two center frequencies were derived for the differential length diplexer and long-stub filter. The general characteristics of these devices are calculated in terms of phase angle with dissipation loss included. An analysis of bandwidth, dimensional and thermal expansion tolerances for these devices is also given. A single algebraic equation relating the diplexer performance and the various parameter first-order deviations is obtained. This relation gives guide lines for adjusting final performance and for predicting the combined effects of dimensional, thermal and frequency deviations upon the general performances. Examples of diplexer and long-stub filter designs and analyses are given. Author (GRA)

N71-27232* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THIN FILM CAPACITIVE BOLOMETER AND TEMPERATURE SENSOR Patent
Joseph Maserjian, inventor (to NASA) Issued 2 Mar. 1971 10 p Filed 14 Feb. 1969 Cl. 317-230; Cl. 317-231; Cl. 317-238; Cl. 250-83; Int. Cl. H01l7/00 Sponsored by NASA
(NASA-Case-NPO-10607; US-Patent-3,568,010; US-Patent-Appl-SN-799353) Avail: US Patent Office CSCL 09A

An improved capacitive element which exhibits a useful change of capacitance with temperature is discussed. The change is provided by increasing the space charge barrier by either of the following: (1) evaporating thinner layers of an insulating metal oxide over both sides of a film of material capable of displaying dielectric properties disposed between two metal electrodes, and (2) by employing a thicker film of anodized metal oxide which contains less ionic space charge than the corresponding film of material used in the first technique. Thermal and mechanical characteristics of devices of this type are optimized by providing a substrate of a metal first evaporated on a glass slide to form a thin foil. Once the foil is bonded over holes on a supporting frame, the glass slide is removed, leading a smooth surface to form the devices on. That surface may be anodized, and once the devices are formed over holes, the unanodized thickness of the foil may be etched off through the holes in the frame leaving devices supported by an anodized film of the foil material.
Official Gazette of the U.S. Patent Office

N71-27253# National Bureau of Standards, Washington, D.C.
DEVELOPMENT AND ANALYSIS OF TECHNIQUES FOR CALIBRATION OF KERR CELL PULSE-VOLTAGE MEASURING SYSTEM, PART 4
Esther C. Cassidy and H. N. Jones Jan. 1971 102 p refs Prepared for Sandia Labs
(Contract 28-9551)
(SC-CR-70-6153) Avail: NTIS

Investigation results on the Kerr electro-optical effect as a means for measuring high-voltage pulses are presented. The extension of Kerr pulse measurement capability to the 300 kV level, investigation and derivation of corrections for temperature and fringing end-field effects, and development of an improved fringe-pattern technique for high direct voltage calibrations are summarized. In addition, a Kerr cell method is described for deriving pulse magnitude measurements directly from photographs of fringe patterns produced by use of a pulsed laser. A computer analysis of simultaneous Kerr system and pulse divider measurements is also included. Author

N71-27306 Cornell Univ., Ithaca, N.Y.
STUDIES OF HIGH CURRENT RELATIVISTIC ELECTRON BEAM PROPAGATION
David Andrew Hammer (Ph.D. Thesis) 1969 142 p
Avail: Univ. Microfilms Order No. 70-5796

Three models are developed involving distinct physical mechanisms which allow the propagation of arbitrarily large currents by an electron beam confined to a finite radius, and then some

experimental observations made on high current electron beams are presented. The first theoretical model discussed is a self consistent, fully relativistic electron beam equilibrium consisting of monoenergetic electrons having the same canonical axial momentum, partially or fully neutralized by infinitely massive positive ions. In the second model, the initial value problem of an electron beam propagating in a large plasma density compared to the beam density is solved in the time asymptotic limit. The final model treats a uniform beam propagating in the presence of a uniform axial magnetic field. Finally, a relativistic electron beam accelerator capable of producing high current beams is briefly described, and some observations made on the accelerator are presented. Dissert. Abstr.

N71-27384* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.

CONSTANT FREQUENCY OUTPUT TWO STAGE INDUCTION MACHINE SYSTEMS Patent

Mahmoud Riaz, inventor (to NASA) Issued 23 Mar. 1971 9 p Filed 21 Nov. 1968 Cl. 322-32; Cl. 321-61; Cl. 321-64; Int. Cl. H02p9/42

(NASA-Case-ERC-10065; US-Patent-3,571,693; US-Patent-Appl-SN-777818) Avail: US Patent Office CSCL 09E

A system employing double-induction machines is described which is capable of providing constant-frequency electrical power from a variable speed drive or of operating as a controlled speed motor from a constant-frequency source. The disclosed system employs two polyphase, wound-rotor induction machines mounted on the same shaft having their rotor windings connected in a reverse phase sequence and their stator windings interconnected by means of a direct-current link-type of static frequency changer. Official Gazette of the U.S. Patent Office

N71-27425# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.

ANTENNA BORESIGHT PARAMETER ESTIMATION Research Report, Jul. – Oct. 1970

Richard M. Terasaki 30 Dec. 1970 34 p

(Contract F04701-70-C-0059)

(AD-720242; TR-0059(6472)-6; SAMSO-TR-51) Avail: NTIS CSCL 9/5

A boresight-calibration test is devised based upon the functional dependence of signal-strength measurements upon the antenna pointing relative to the direction to a ground-based transmitter. Algorithms are herein developed for the estimation of the antenna-boresight orientation relative to the spacecraft-attitude reference axes, the antenna beamwidths, and the boresight signal strength. Expressions for the expected error in the boresight parameter estimation are stated. Results of a computer simulation of the estimation process are included; they agree with the theoretically expected performance. Formulas are included for the transformation of attitude and orbital parameters to determine the antenna-pointing direction. Author (GRA)

N71-27668# Army Research and Development Group (Europe), New York 09510.

WORK AT THE NORWEGIAN INSTITUTE OF TECHNOLOGY AT TRONDHEIM ON AMPLIFICATION IN PERIODIC SEMICONDUCTORS

Irvin G. Kinnie 8 Feb. 1971 10 p

(AD-720996; E-1449) Avail: NTIS CSCL 9/1

The report covers the status of work and (briefly) the theory supporting the work on Amplification in Periodic Semiconductors under Contract DAJA37-70-C-2646. Author (GRA)

N71-27747# ITT Electron Tube Div., Fort Wayne, Ind.

PATTERN THRESHOLD RECOGNITION DEVICE Final Report, Jul. 1969 – Sep. 1970

J. M. Abraham, R. W. Hunter, and L. G. Wolfgang Feb. 1971 98 p refs

(Contract DAAB07-69-C-0471)

(AD-721021; ECOM-0471-F) Avail: NTIS CSCL 9/1

The report details effort directed toward development of a Pattern-Recognition Device. This vacuum-tube consists of an image-converter input, a storage-target which can be switched over the secondary-emission first-crossover potential in areas of intense signal, a flood-gun to suppress background information, and a read-gun to provide an electrical output of the stored information. The report discusses four main tasks which culminated in the Pattern-Recognition Device. The task of target-development includes fabrication technhe task to develop an image-converter input and a flood-gun collimation-system are presented. The task to design a suitable read-gun is discussed, and finally the results obtained on the final-design tubes are presented. Author (GRA)

N71-27778# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.

DENSITY DISTRIBUTION MEASUREMENTS IN RAREFIED GASES CONTAINED BETWEEN PARALLEL PLATES AT HIGH TEMPERATURE DIFFERENCES

Darryl J. Alofs, Richard G. Flagan, and George S. Springer [1970] 5 p refs Presented at 7th Intern. Symp. on Rarefied Gas Dynamics, Pisa, Italy, 29 Jun. 1970 Sponsored by AEC

(COO-2032-4; CONF-700644-1) Avail: AEC Depository Libraries

Local gas densities in rarefied helium and nitrogen at rest between plates at 79 K and 294 K, respectively, were measured over a range of Knudsen numbers from 0.03 to 0.6. The densities were determined by measuring the luminescence produced by a narrow beam of high energy electrons through the gas. Experimental data were compared to analytical results from a four moment method, and the maximum difference was found to be 10%. N.E.N.

N71-27777# Battelle-Northwest, Richland, Wash.

NONDESTRUCTIVE TESTING APPLICATIONS OF THERMAL TRANSDUCERS

L. D. McCullough 18 May 1970 13 p Presented at 15th Meeting of the NDT Groups of the AEC Weapons Program, Miamisburg, Ohio 8 Apr. 1970

(Contract AT(45-1)-1830)

(BNWL-SA-3289; CONF-700435-1) Avail: NTIS

The thermal transducer and some of its applications, particularly testing flat carbon-carbon composites, are briefly described. The transducer utilizes an electrically conductive foil coated with a temperature sensitive phosphor, and can be used to detect any anomaly affecting the thermal properties of the test material and to test bond integrity of metal-nonmetal honeycombs. Test apparatus for examining a 40-inch frustrum of carbon-carbon composite is also described. N.E.N.

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N71-28667# Los Alamos Scientific Lab., N.Mex.

DYNAMIC MEASUREMENT OF STOPBAND IN LAMPF 805 MHz ACCELERATOR STRUCTURES AT HIGH POWER USING HYBRID COMPUTER TECHNIQUES

R. A. Jameson and J. D. Wallace Jan. 1971 5 p refs

(Contract W-7405-eng-36)

(LA-4593) Avail: NTIS

A method, using a hybrid computer, of performing high speed stopband calculations on the 805 MHz side coupled linac

is discussed. Results of both transient and steady state cases are included. (Stopband is defined as frequency spacing between the normal excitation mode of the structure and the next higher mode, minus the frequency spacing between the normal mode and the next lower mode. The next higher and lower modes are taken as the nearest strongly excited modes as determined by the point drive and symmetry.) Author (NSA)

N71-26983# Sandia Corp., Albuquerque, N.Mex. Engineering Applications Div.

TRANSFER FUNCTION MODELS OF DTL AND TTL INTEGRATED CIRCUITS

M. E. Daniel and L. J. O'Connell Dec. 1970 67 p refs
(SC-RR-70-650) Avail: NTIS

A method is developed for mathematically representing the volt-ampere characteristics of diode-transistor logic(DTL) and transistor-transistor logic(TTL) integrated circuits. The transfer-function, or black-box, model empirically approximates the input and output impedances, the voltage transfer function, and the propagation delay. Piecewise linear representations, which account for variations in temperature and supply voltage, are used for both the input and output characteristics. This modeling approach is very efficient, a 4-input NAND gate requiring one-third(or less) the number of elements and one-tenth(or less) the amount of computer central processing unit (CPU) run time as compared to models using a large-signal equivalent circuit for each active device. The method is extendable to more complex IC's where it becomes even more efficient relative to classical modeling with discrete components. The models account for variations in temperature and supply voltage. Author

N71-27128* Westinghouse Electric Corp., Lima, Ohio

TRANSISTOR DRIVE REGULATOR Patent

Richard J. Ravas, inventor (to NASA) Issued 23 Feb. 1971 4 p Filed 7 Aug. 1968 Cl. 307-253; Cl. 307-300; Int. Cl. H03k17/04 Sponsored by NASA
(NASA-Case-LEW-10233; US-Patent-3,566,158; US-Patent-Appl-SN-750787) Avail: US Patent Office CSCL 09C

A drive circuit for a semiconductor switch has a variable conducting means connected between a drive signal source and the switch. The variable conducting means is connected in controlled relationship to the driving source through a voltage dropping means and drive current diverting means bypasses some drive current around the variable conducting means. Means for decreasing the turnoff time of the switch is also provided. Official Gazette of the U.S. Patent Office

N71-27127# Naval Postgraduate School, Monterey, Calif.

SUBHARMONIC RESONANCE IN A LIMIT CYCLING VOLTAGE REGULATOR

M. Ali Gveler (M.S. Thesis) Dec. 1970 107 p refs
(AD-720701) Avail: NTIS CSCL 12/1

In practice, thyristor rectifiers are used as high current-low power supplies. Under certain conditions such rectifiers introduce subharmonic resonances. In this paper, a limit cycling voltage regulator system is simulated in the digital computer. The reference voltage and load are varied and the system gain is changed for better understanding of their effects on the subharmonics. A Fourier analysis of the output wave shape then determined the existence and amplitude of subharmonic components. Author (GRA)

N71-27138* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SYNCHRONOUS dc DIRECT DRIVE SYSTEM Patent

Leo J. Veillette, inventor (to NASA) Issued 2 Mar. 1971 13 p Filed 19 Mar. 1969 Cl. 318.571; Cl. 318-653; Int. Cl. G05b19/24
(NASA-Case-GSC-10085-1; US-Patent-2,568,028; US-Patent-Appl-SN-808462) Avail: US Patent Office CSCL 09C

A multiple-loop hybrid control system is described for controlling a load, which is directly connected to an actuator. It includes an offset-tooth magnetic sensor which senses output shaft movement and generates position and rate information needed for system control. A command waveforms generator provides command and comparison signals that are compared with the processed magnetic sensor information in suitable electronic comparing loops. The output signals from the electronic comparing loops are utilized to control the movement of the actuator and load. Official Gazette of the U.S. Patent Office

N71-27137* Computer Control Co., Inc., Framingham, Mass.

COUNTER Patent

William E. Baumer and John D. Timm, inventors (to NASA) Issued 2 Mar. 1971 5 p Filed 24 Apr. 1968 Cl. 235-92; Cl. 328-49; Int. Cl. H03k2/16; Int. Cl. G06m3/02 Sponsored by NASA
(NASA-Case-XNP-06234; US-Patent-3,567,913; US-Patent-Appl-SN-723827) Avail: US Patent Office CSCL 09C

A pulse counting apparatus is described capable of operating over a wide range of pulse rates, which indicates the exact time of occurrence of pulses occurring at long intervals and the pulse rate for pulses occurring at short intervals. The circuit comprises a first portion for registering the first seven pulses to be received, a second portion for counting the number of clock signals generated before a first pulse is received by the counting apparatus, and a third portion for erasing the clock signal count in the second portion and enabling the second portion to count additional pulses received by the counter when seven or more pulses have been received. Official Gazette of the U.S. Patent Office

N71-27271* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIDEBAND VCO WITH HIGH PHASE STABILITY Patent

Chase P. Hearn, inventor (to NASA) Issued 9 Mar. 1971 4 p Filed 26 Nov. 1968 Cl. 331-117; Cl. 331-109; Cl. 331-177; Cl. 332-30; Int. Cl. H03b5/12
(NASA-Case-XLA-03893; Us-Patent-3,569,866; US-Patent-Appl-SN-779024) Avail: US Patent Office CSCL 09C

A wideband voltage controlled oscillator of high phase stability is described with a resonator consisting of identical L-C resonators coupled to the input and the output of a phase stable amplifier. The resonant frequency of each resonator is controlled by applying a modulating signal to voltage variable capacitors. In addition, the amplifier has electrically-variable negative feedback which improves its phase stability, and provides sinusoidal oscillations. Official Gazette of the U.S. Patent Office

N71-27272* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PLURAL POSITION SWITCH STATUS AND OPERATIVENESS CHECKER Patent

Leon V. Taylor, inventor (to NASA) Issued 23 Mar. 1971 10 p Filed 15 Sep. 1967 Cl. 340-166; Cl. 340-150; Cl. 340-164; Cl. 340-213; Cl. 340-403; Int. Cl. H04g1/00; Int. Cl. H04g3/00; Int. Cl. H04g5/00
(NASA-Case-XLA-08799; US-Patent-3,571,800; US-Patent-Appl-SN-668242) Avail: US Patent Office CSCL 09C

An apparatus is described for checking the status of switches. A matrix of magnetic core is connected to the common terminals of double-throw switches. A pulse is applied to the normally closed side of the switches. This pulse energizes any of the cores that are connected to switches that are in the normally closed position. The matrix of magnetic cores is then read out. Following this, a pulse is applied to the normally open side of the switches. This second pulse energizes any of the cores that are connected to switches that are in the normally open position and the matrix is again read out. The readouts are then compared. If the readouts for any particular switch are complements, the status of the switch can be identified. If the readouts for any particular switch are the

same, a detective switch condition or a defective switch wiring condition is indicated. The status and operativeness of the switches are both determined by the invention.
Official Gazette of the U.S. Patent Office

N71-27287# Stanford Univ., Calif. Electronics Labs.
ON RAPID CALCULATING TECHNIQUES FOR THE RELIABILITY OF SERIAL TRIPLE-MODULAR REDUNDANCY
Daniel P. Siewiorek Oct. 1970 17 p refs
(Contract N00014-67-A-0112-0044; Grant NSF GJ-165)
(AD-720332; TN-5) Avail: NTIS CSCL 9/2

Several papers have been written on the rapid reliability calculation of a triple-modular redundancy version of a cascade network. The different approaches to the problem are briefly reviewed and a third approach, developed by Lyons, is extended. Equations to approximate the maximum obtainable reliability using TMR are given for both the single and triplicated voter case. An example serves to indicate how close an approximation may be expected. A lower bound on voter reliability is also developed.
Author (GRA)

N71-27288# Stanford Univ., Calif. Electronics Labs.
DERIVATION OF MINIMUM TEST SETS FOR UNATE LOGICAL CIRCUITS
Rodolfo Betancourt Aug. 1970 28 p refs
(Contract N00014-67-A-0112-0044; Grant NSF GJ-165)
(AD-720330; TN-3) Avail: NTIS CSCL 9/2

A derivation of tests sets S sub 0 and S sub 1 for irredundant unate logical circuits is presented. It is shown that these sets (S sub 0 and S sub 1, respectively) detect all stuck-at-0 and stuck-at-1 faults in all realizations with no internal inverters of a given unate function. They can be obtained easily from the minimum sum and minimum product forms, from a Karnaugh map or from a Hasse diagram of the function. These sets are minimum in the sense that there is no set with a smaller number of elements that detects all faults in the class of realizations of a logical function. In particular, it is found that a two-level AND-OR (OR-AND) network needs all the tests in S sub 0 (S sub 1).
Author (GRA)

N71-27329 Georgia Inst. of Tech., Atlanta.
DESIGN OF MODEL REFERENCE ADAPTIVE CONTROL SYSTEMS USING LIAPULNOV THEORY
Eugene Henry Lowe, III (Ph.D. Thesis) 1970 136 p
Avail: Univ. Microfilms Order No. 70-12970

Several results on the design of model reference adaptive control systems are given. The objective of the design is to synthesize a control signal for the plant. The control signal forces the output of the plant to be identical to the output of the reference model. Furthermore, errors in the overall system obey a Liapunov stability theorem which guarantees that all errors approach zero asymptotically. By considering the internal states of the plant and the model only as they affect the outputs, a control policy is derived which allows the plant and the model to be of different orders. Furthermore, the plant and model need not be linear, time invariant, or continuous. They need not even be of the same form, time varying, except that both must be either continuous or discrete. The plant may have incompletely specified parameters which lie within known bounds. The obtained results apply both to single input, single output systems and to multiple-input, multiple-output systems. Examples are presented throughout the thesis to illustrate the application of the various results.
Dissert. Abstr.

N71-27338* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
VOLTAGE DROPOUT SENSOR Patent
Walter H. Houck, inventor (to NASA) Issued 23 Mar. 1971 5 p Filed 18 Apr. 1969 Cl. 324-107; Cl. 324-103; Cl. 324-133; Cl. 340-248; Int. Cl. G01r19/00; Int. Cl. G01r19/16; Int. Cl. G08b21/00
(NASA-Case-KSC-10020; US-Patent-3,571,707; US-Patent-Appl-SN-817482) Avail: US Patent Office CSCL 09C

A system is described for monitoring the output voltages of a power source by generating a signal when voltages drop below a predetermined amplitude value. The capability of monitoring multiphase voltages is provided by a summing circuit.
Official Gazette of the U.S. Patent Office

N71-27342# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
LINEAR STOCHASTIC SINGULAR CONTROL PROBLEMS
Yu-Chi Ho Feb. 1971 17 p refs
(Contract N00014-67-A-0298-0006)
(AD-720341; TR-619) Avail: NTIS CSCL 12/1

The explicit feedback control law for the singular linear-quadratic-gaussian stochastic control problem is derived. The interesting implication of the control law in terms of information pattern is discussed.
Author (GRA)

N71-27368* Gulf General Atomic, San Diego, Calif.
WAVEFORM SIMULATOR Patent
Charles D. Moore and John H. Malmberg, inventors (to NASA) Issued 16 Mar. 1971 6 p Filed 8 Nov. 1968 Cl. 35-19; Int. Cl. G09b23/18 Sponsored by NASA
(NASA-Case-NPO-10251; US-Patent-3,570,143; US-Patent-Appl-SN-774265) Avail: US Patent Office CSCL 09C

An apparatus for simulating a waveform consisting of a mixture of exponentially damped sine waves is described. The apparatus generates a series of damped sine waves of variable amplitude, frequency, damping factor, and phase. These waveforms are added and displayed on an oscilloscope. Their parameters are adjustable to obtain a complex waveform which simulates a curve to be analyzed.
Official Gazette of the U.S. Patent Office

N71-27386* Honeywell, Inc., Minneapolis, Minn.
FAILURE SENSING AND PROTECTION CIRCUIT FOR CONVERTER NETWORKS Patent
Kenneth J. Jensen, inventor (to NASA) Issued 23 Mar. 1971 4 p Filed 4 Feb. 1971 Cl. 317-33; Cl. 321-12; Int. Cl. H02h7/10 Sponsored by NASA
(NASA-Case-GSC-10114-1; US-Patent-3,571,662; US-Patent-Appl-SN-796370) Avail: US Patent Office CSCL 09C

A failure sensing and protection circuit is described for use with converter networks. The collector-emitter terminals of a power switching transistor are connected in series between a source of power and a converter. A sensing transistor adapted to sense the ac operation of the converter is connected through a current amplifying circuit to the base of the power transistor. In addition, proportional current drive for the power transistor is provided by connecting the current amplifier circuit through a current transformer to sense a signal that is proportional to the current flow in the collector of the power transistor. The drive of the power transistor stops when converter failure occurs because the signal applied to the sensing transistor ends.
Official Gazette of the U.S. Patent Office

N71-27988*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
PHYSICAL ELECTRONICS AND SURFACE PHYSICS
J. E. Franklin and R. E. Stickney Repr. from Quart. Progr. Rept. no. 101, 15 Apr. 1971 p 25-48 refs
(Grant NGR-22-009-091; Contract DA-28-043-AMC-02536(E))
(NASA-CR-118897; QPR-101) Avail: NTIS CSCL 09C

An approximative analysis of the oxygen pumping effect in the chemical reaction of O2 with a hot tungsten cathode is developed. It is assumed that a fraction of the impinging O2 molecules is equilibrated to the tungsten surface and that the

remainder is scattered and rebound as O2 molecules. The chemical composition of the products evaporating from the surface is held to be identical to that of an equilibrium mixture at the temperature of the solid so that evaporation rates are related through equilibrium constants. This quasi-equilibrium analysis also provides an approximative explanation of impurity evaporations from the filament as ions. Also described is a simplified method for determining enthalpies and free energies of formation of volatile species that form in gas-solid chemical reactions at high temperatures and low pressures. The principle feature of this procedure is a Langmuir source for attaining molecular flow conditions and mass spectrometric measurements of the rates of species evaporating from the probes surface as ions. G.G.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N71-26803# Federal Aviation Administration, Washington, D.C.
MEASUREMENT OF RUNWAY FRICTION CHARACTERISTICS ON WET, ICY OR SNOW COVERED RUNWAYS Progress Report
1 Apr. 1971 19 p refs
(FS-160-65-68-1) Avail: NTIS

Three methods of measuring runway friction characteristics are described and possible usage of the data obtained is indicated. The information presented reflects the current state-of-the-art for measurement and classification of the relative slipperiness of runway surfaces. The three methods described include: (1) the diagonal-braked vehicle test method for measuring stopping distances on paved surfaces, (2) the Mu Meter method for evaluating runway surface characteristics, and (3) the James Brake Decelerometer method for determining runway slipperiness in the form of a friction coefficient. D.L.G.

N71-26880# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
SHELTER: TENTS (AVIATION) Final Report
9 Mar. 1971 19 p refs
(AD-721153; MTP-7-3-056) Avail: NTIS CSCL 1/5

Procedures are prescribed for evaluating the functional suitability of tents developed for aviation use. Author (GRA)

N71-26943# Sandia Corp., Albuquerque, N.Mex.
AERODYNAMIC FORCES AND DYNAMIC STABILITY OF A HIGH SPEED, MAGNETICALLY SUSPENDED ROCKET SLED
H. M. Dodd, Jr. and D. L. Preston Jan. 1971 54 p refs
(SC-DR-70-867) Avail: NTIS

The aerodynamic forces and dynamic stability were investigated of a magnetically suspended rocket sled moving at velocities of Mach 4 to Mach 10 close to a stationary wall. An analytical model is developed and experimental verification is obtained from conventional rocket sled tests. Results show that a previous technique yielded aerodynamic lift forces which were an order of magnitude too low. As a consequence, an example dynamic model which previously was found to be stable became unstable in both longitudinal and lateral modes. Author

N71-26984# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
A HIGH SENSITIVITY ULTRASONIC TEST SYSTEM FOR WELDS
P. A. Fessler and W. E. Michaud 11 Nov. 1970 20 p
(Contract AT-(20-2)-656)
(GEPP-83) Avail: NTIS

The scanning and recording equipment are described of a semi-automatic ultrasonic test system used for the inspection of electron beam welds. The equipment inspects an electron beam weld in stainless steel parts and is capable of indicating defects not detectable with conventional X-ray radiographic equipment. Nearly a year's production testing has proven that flaws which are as small as 0.015 inch in diameter and located as deep as one quarter of an inch below the surface of the part can be detected repeatedly. Misaligned welds, short welds and cracks are readily shown. The inspection takes about one minute. The ultrasonic information is electronically displayed and stored on the cathode ray tube of a storage display unit. Polaroid photographs of the display provide permanent records of each weld inspected. Author

N71-27034# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Raumfahrt-Aerodynamik.
THE SECOND TEST SECTION OF THE AVA HYPERSONIC LOW DENSITY WIND TUNNEL: DESCRIPTION AND OPERATIONAL BEHAVIOR [DIE ZWEITE MESSSTRECKE DES HYPERSONISCHEN VAKUUMWINDKANALS DER AVA-BAUBESCHREIBUNG UND BETRIEBSVERHALTEN]
G. Hefer Sep. 1970 73 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-42; AVA-FB-70-23) Avail: NTIS; ZLDI Munich: 23,10 DM

The second test section of the hypersonic low density wind tunnel has been put into operation. This facility, operating with air and having a test section diameter of 40 cm allows Mach numbers between 10 and 22. The stagnation temperature can be varied from 400 to 1200 K, the stagnation pressure from 0.2 to 20 atmospheres, yielding a test section mean free path between 0.01 and 1 mm. The test facility is described and the operational behavior, investigated by extensive calibration measurements, is dealt with. Author (ESRO)

N71-27035# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Raumfahrt-Aerodynamik.
INVESTIGATION OF A LIQUID NITROGEN COOLED NOZZLE OF THE HYPERSONIC LOW DENSITY WIND TUNNEL [ERPROBUNG EINER MIT STICKSTOFF GEKUEHLTEN DUESE DES HYPERSONISCHEN VAKUUMWINDKANALS]
G. Hefer and K. Kienappel Sep. 1970 36 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-41; AVA-FB-7024) Avail: NTIS; ZLDI Munich: 11,10 DM

In order to extend the test range of the first test section of the hypersonic low density wind tunnel to lower Reynolds numbers this facility has been equipped with a liquid nitrogen cooled nozzle. Extensive pitot pressure surveys have been made to investigate the influence of liquid nitrogen cooling on the test section flow field. It is shown that with this new nozzle much lower test section Reynolds numbers can be achieved. Author (ESRO)

N71-27036* Electro-Optical Systems, Inc., Pasadena, Calif.
MATERIAL HANDLING DEVICE Patent
Douglas G. Ritchie, inventor (to NASA) Issued 13 Apr. 1971 6 p Filed 6 Oct. 1969 Cl. 74-18.2; Int. Cl. F16j15/52 Continuation-in-part of US Patent Appl. SN-700120, filed 24 Jan. 1968 Sponsored by NASA Prepared for JPL
(NASA-Case-XNP-09770-3; US-Patent-3,574,286; US-Patent-Appl-SN-863967) Avail: US Patent Office CSCL 13C

A device for use on unmanned spacecraft is described which separates and screens particles for viewing soil samples in a

vacuum and reduced gravity environment. It includes a bin for receiving soil samples, and a mechanism for vibrating the bin so that particles pass through coarse and fine screens into various chambers. The sized particles are deposited on plastic sheets which slide on a stage to a position for viewing under a vidicon tube. F.O.S.

N71-27060# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Raumfahrt-Aerodynamik.

CALIBRATION OF A MACH-7 NOZZLE FOR THE FIRST TEST SECTION OF THE AVA HYPERSONIC WIND TUNNEL [EICHUNG EINER MACH-7-DUESE FUER DIE ERSTE MESSSTRECKE DES HYPERSONISCHEN WINDKANALS DER AVA]

G. Hefer Sep. 1970 38 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-43; AVA-FB-70-22) Avail: NTIS; ZLDI Munich: 11,70 DM

In the first test section of the low density wind tunnel the hypersonic flow is produced by expanding the test gas in a conical nozzle, yielding a Mach number of approximately 20. Retaining the test section diameter of 0.25 m, the Mach number has been decreased to approximately 7 by increasing the nozzle throat area. The attainable test range is estimated and the first flow field measurements in the nozzle and in the test section are presented. Author (ESRO)

N71-27075# Bonn Univ. (West Germany). Inst. fuer Physik.

DESIGN AND CALIBRATION OF A NEUTRAL GAS SPECTROMETER WITH AN OPEN AND FILAMENT FREE ELECTRON IMPACT ION SOURCE FOR NUMBER MEASUREMENTS IN THE UPPER ATMOSPHERE [AUFBAU UND KALIBRIERUNG EINES NEUTRALGASSPEKTROMETERS MIT OFFENER, KATHODENLOSER ELEKTRONENSTOSS-IONENQUELLE FUER DICHTEMESSUNGEN IN DER OBEREN ATMOSPHAERE]

H. Trinks Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Feb. 1971 50 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-EB-W-71-06) Avail: NTIS; ZLDI Munich: 10,50 DM

Up to now a reliable determination of the density of atomic oxygen in the atmosphere by means of mass spectrometers has not been accomplished. Presumably losses of O occur at the ion source walls and at the filament. Therefore a mass spectrometer has been developed having an electron impact ion source where the electrons are produced by a multiplier together with an UV lamp. For minimizing the influence of impacts at the walls the ion source was designed with a wide open geometry. The spectrometer was calibrated by means of a gas flow method with a gas flow of 50 l/s produced by a helium cooled cryopump. Neither oil nor mercury pumps were employed in the system. The calibration results are given, the calculated mass discrimination curve is discussed and compared with that of a monopole spectrometer using an ion source with a hot filament. Author (ESRO)

N71-27133# Brookhaven National Lab., Upton, N.Y.

DESIGN STUDY OF A COLD MAGNET SYNCHROTRON (CMS)

A. van Steenbergen, comp. Oct. 1970 192 p refs
(BNL-15430) Avail: NTIS

Results of a conceptual design study for a proton synchrotron using either superconducting or cryogenically cooled pure aluminum magnets for the energy range 100 to 150 GeV are presented and discussed. NSA

N71-27161# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Aerodynamik.

MEASUREMENT OF THE WIND TUNNEL TURBULENCE BY THE HOTWIRE METHOD AND REDUCTION OF WIND TUNNEL OSCILLATIONS [MESSUNG DER WINDKANALTURBULENZ NACH DER HITZDRAHTMETHODE UND BESEITIGUNG VON WINDKANALSCHWINGUNGEN]

H. Eckelmann Sep. 1970 69 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-39; AVA-FB-70-21) Avail: NTIS; ZLDI Munich: 21,30 DM

Turbulence level measurements in a subsonic wind tunnel were carried out. For this purpose a new transistor hot wire anemometer was developed. Author (ESRO)

N71-27206# Naval Civil Engineering Lab., Port Hueneme, Calif.

AIRFIELD PAVEMENT CONDITION SURVEY, USNAS, POINT MUGU, CALIFORNIA

D. J. Lambiotte and R. B. Brownie Feb. 1971 96 p refs
(AD-720319; NCEL-TN-1148) Avail: NTIS CSCL 13/2

The results of a condition survey of the airfield pavements at the U. S. Naval Air Station, Point Mugu, California are presented. The survey established statistically-based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts. Author (GRA)

N71-27269# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

REMOTE HANDLING IN OPERATION OF THE INSTALLATION ATTILA [LA TELEMANIPULATION DANS L'EXPLOITATION DE L'INSTALLATION ATTILA]

Y. Rochedereux, E. Jeantet, M. Bourgeois, and M. Perrot Oct. 1970 41 p refs In FRENCH
(CEA-R-4067) Avail: AEC Depository Libraries

The remote handling equipment and the remotely operated systems used in the ATTILA facility are described. Experience obtained during 18 months of cell operation in the field of nonaqueous reprocessing is presented and discussed. Author (NSA)

N71-27582# Japan Atomic Energy Research Inst., Tokyo.

ACTIVITIES IN THE DIVISION OF HEALTH PHYSICS AND SAFETY, 1 APRIL 1969 – 31 MARCH 1970

Jun. 1970 111 p refs In JAPANESE; ENGLISH summary
(JAERI-5025) Avail: AEC Depository Libraries

Routine monitoring and maintenance activities of the division include: accident prevention measures, safety countermeasures, results of external and internal personnel monitoring, monitoring data for nuclear facilities, results of environmental monitoring, maintenance and calibration of monitors and surveymeters, and routine radioactive waste treatment and decontamination. In the area of radiation and operational safety techniques, divisional activities included: development of safety control systems, design and testing of new internal and external personnel monitoring instrumentation, operational testing of particle filters and failed-fuel detectors in nuclear facilities, design and improvement of environmental monitoring instruments; characterization of alpha particle and tritium monitoring instruments, and improved radioactive waste treatment and decontamination facilities. Research activities in the division included the following areas: radiation dosimetry, body radioactivity, aerosol technology, environmental radiation and contamination, and treatment of liquid radioactive waste. NSA

N71-27708*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPERIMENTS ON THE EFFECT OF ULTRAVIOLET ON CONTAMINATION IN VACUUM SYSTEMS
Raymond Kruger and Harold Shapiro Apr. 1971 8 p
(NASA-TM-X-65571; X-322-71-165) Avail: NTIS CSCL 14B

Experiments carried out in an otherwise empty vacuum chamber are described. Data obtained with the quartz crystal microbalance show that, under ultraviolet irradiation, clean and contaminated mean different things than in situations that do not involve irradiation. The history of the chamber appears to be of paramount importance, not the pumping mechanism. The UV irradiation check for contamination is recommended in critical experiments. Author

N71-27775# Los Alamos Scientific Lab., N.Mex.
HYDROGEN PRESSURE IN VACUUM SYSTEMS WITH CRYO-CONDENSATION PUMPS [WASSERSTOFFDRUCK IN VAKUUMSYSTEMEN MIT KRYO-KONDENSATIONSPUMPEN]
G. Grosse et al [1970] 12 p refs Transl. into ENGLISH of German conf. paper Presented at 3d Intern. Cryog. Eng. Conf., Berlin, 25–27 May 1970
(LA-tr-71-15; Conf-700522-3) Avail: NTIS

Vapor pressure which does not correspond to an equilibrium state of a closed system was noted at approximately 2.8 K during cryopumping of hydrogen. The pressure occurs only with the existence of a condensation flow and depends on the covering of the cold surface. It can be detected immediately after halting the influx and it decreases only very slowly. The effect of tempering the hydrogen condensate and measurements of the reflection (or condensation) coefficients, which are dependent on the state of the condensate, are discussed. Pressure measurements after the tempering at different condensate temperatures agree with the values obtained previously. Author

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N71-26881# Ohio State Univ. Research Foundation, Columbus.
A FOG GENERATOR AS APPLIED TO VISUALIZATION IN COMPRESSIBLE FLOW Final Report
Richard E. Rosenberg Wright-Patterson AFB, Ohio ARL Dec. 1970 16 p refs
(Contract F33615-67-C-1758)
(AD-721193; ARL-70-0358) Avail: NTIS CSCL 14/2

An apparatus was developed to generate a water saturated air stream (fog), which is used for visualization purposes in compressible flows. This visualization technique applies the humid air relationships and is explained by use of an extended Mollier h,x-diagram extended to a high pressure. Author (GRA)

N71-26882# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
FINITE DIFFERENCE METHOD FOR TRANSIENT TWO-PHASE COMPRESSIBLE FLOW
W. J. Turner Aug. 1970 14 p refs Submitted for publication
(AAEC/TM-558) Avail: AEC Depository Libraries

In CANDU reactors the depressurization phenomena can be divided into two parts. First, the pressure in the liquid part of the coolant circuit drops over a few milliseconds to the saturation pressure of the coolant. In the second part where the system pressure decreases to atmospheric over at least 10 seconds, sonic effects are not of interest, but the dependence of the coolant density on pressure must be included. Time steps of the order of the time for a sonic wave to pass through one space step were necessary in the analysis, but a finite difference method was developed which allows much larger time steps. All the derivatives and the frictional pressure drop in the conservation equations are forward-averaged in time. The implicit equations obtained together with the boundary conditions are then solved by a noniterative method to obtain the enthalpy, flow and pressure at all space points at the end of the time step. The computation required per time step is proportional to the number of space points. Author (NSA)

N71-27061# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Gasdynamik.
VORTEX BREAKDOWN
H. Ludwieg Sep. 1970 27 p refs Presented at the Meeting on Transition from Laminar to Turbulent Flow, London, 1–6 Jul. 1968
(DLR-FB-70-40; AVA-FB-7020) Avail: NTIS; ZLDI Munich: 8.10 DM

Vortex breakdown, an abrupt change in the velocity distribution of a vortex, is often observed under quite different conditions. The various theories for the explanation of the phenomenon are discussed. It is concluded that various physical phenomena may cause a vortex breakdown, so that it is not possible to explain all observed breakdown processes by one theory only. Author (ESRO)

N71-27068# Sandia Corp., Albuquerque, N.Mex.
SOLUTION FOR THE CORRELATION FUNCTIONS IN A HOMOGENEOUS ISOTROPIC INCOMPRESSIBLE TURBULENT FIELD
R. L. Fox Feb. 1971 58 p refs Sponsored by AEC
(SC-RR-70-912) Avail: NTIS

A system of equations for the multipoint distribution functions in a homogeneous turbulent field is developed from the incompressible Navier-Stokes equation. The equation for the two point distribution is solved for an isotropic medium. The time evolution of the velocity correlation function is obtained from moments of the two point distribution. The effects of the initial conditions and Reynolds number on the decay of the turbulent field is studied for some simple initial conditions. Author

N71-27088# Iowa State Univ. of Science and Technology, Ames.
INTERNAL FLOW PATTERNS OF FORMING LIQUID DROPS
Philip Wayne Weathers (M.S. Thesis) Nov. 1970 45 p refs
(Contract W-7405-eng-82)
(IS-T-440) Avail: NTIS

The internal motion of a forming drop was studied by photographing the motion of aluminum particles inside the drop. Various mixtures of mineral oil and Varsol were used for the drop phase, and distilled water was used as the continuous medium. An ordered circulation pattern was observed in a forming drop; however, this pattern varied with the fluid viscosity and velocity. A distinct relationship between velocity and viscosity was found for the point where the maximum amount of new material reached the interface due to circulation. This maximum degree of circulation was observed at Reynolds numbers 29 to 41 and greater over the entire range of viscosity and velocity. A velocity-viscosity relationship was also found for the point where no circulation occurred in a forming drop. This minimum circulation was observed at Reynolds number of 4.1 to 16.1 and less for all velocities and viscosities. Author

N71-27088# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
DYNAMICS OF VAPOUR BUBBLES IN LIQUID HYDROGEN

AND ULTRASONIC BUBBLE CHAMBERS
V. A. Akulichev, V. N. Alekseev, and K. A. Naugolnykh 1970 15 p In RUSSIAN
(JINR-P13-5327) Avail: AEC Depository Libraries

The dynamics of vapor bubbles in liquid in an ultrasonic field is considered theoretically. A system of equations is formulated describing the pulsation of a single vapor bubble in the approximation of an incompressible liquid. It is shown that a vapor bubble increases under the influence of the ultrasonic field reaching an asymptotic size. The calculated results of the bubble dynamics in liquid hydrogen are presented for the thermodynamical parameter values corresponding to the characteristic modes of bubble chambers. Author (NSA)

N71-27183# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
HEAT EXCHANGE FOR TWO PHASE FLOW IN HORIZONTAL AND VERTICAL TUBES [ECHANGE THERMIQUE EN DOUBLE PHASE DANS DES TUBES VERTICAUX OU HORIZONTAUX]
R. Ricque and R. Roumy [1970] 11 p refs In FRENCH Presented at the 4th Intern. Heat Transfer Conf., Versailles, France, 31 Aug.–5 Sep. 1970
(CEA-CONF-1649; CONF-700805-4) Avail: AEC Depository Libraries

Experimental results for heat transfer with two-phase fluid flow in heated tubes were obtained using Freon-12 and are presented. After preliminary studies with vertical tubes to determine the importance of the effects of bends in the tubing, it was possible to precisely define burnout conditions for dispersed flow in a horizontal tube section preceding a tubing bend. Author (NSA)

N71-27207# Institute of Nuclear Research, Warsaw (Poland).
NUMERICAL CALCULATIONS OF THE ELECTRICAL PARAMETERS IN A FARADAY-TYPE MHD GENERATOR WITH TWO-DIMENSIONAL GAS FLOW
Z. Celinski 1970 34 p refs
(INR-1199) Avail: AEC Depository Libraries

The two-dimensional electrical network was assumed as a model of the two-dimensional gas flow in MHD channels. Applying the calculated velocity and temperature profiles, the network was solved using the GIER computer. All electrical values, the terminal ones as well as local, were calculated. The constant channel cross section, the subsonic gas flow, and the uniform distribution of the gas parameters along the channel were assumed in the calculations. The distribution of the gas parameters was assumed to be independent of the generator loading. The channel end effects were neglected. Author

N71-27321 Brown Univ., Providence, R.I.
AN EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF THE MECHANISM UNDERLYING THE INFLUENCE OF FREE-STREAM TURBULENCE ON THE STAGNATION-LINE HEAT TRANSFER FROM CYLINDERS IN CROSS FLOW
Ralph Tabor Wood (Ph.D. Thesis) 1969 148 p
Avail: Univ. Microfilms Order No. 70-8813

Measurements of mass-transfer rates in the presence of streams of different turbulence intensities (0.2% - 7%) are reported. Experiments with oil-coated cylinders revealed the existence of a three-dimensional structure to the flow. The influence of several parameters on the streak spacing, i.e., the disturbance wavelength, was determined and a correlation was effected. The results showed that the wavelength decreased as either the turbulence intensity or the Reynolds number increased. A direct confirmation of the three-dimensional nature of the flow was obtained by means of hot-wire anemometry. The flow pattern is seen to consist of cellular roll-type disturbances whose axes lie parallel to the boundary-layer edge and extend transversely across the stagnation line. The existence of the three-dimensional boundary-layer structure is attributed to a flow instability, and several related stability theories are discussed. It is suggested that the primary role of free-stream turbulence is to set the amplitude of the three-dimensional disturbance. Dissert. Abstr.

N71-27322 Brown Univ., Providence, R.I.
AN APPROXIMATE METHOD FOR THE SOLUTION OF TIME DEPENDENT BOUNDARY VALUE PROBLEMS IN KINETIC THEORY
Harold Lee York (Ph.D. Thesis) 1969 67 p
Avail: Univ. Microfilms Order No. 70-8815

An approximate method developed to solve model equations in kinetic theory was shown to provide a good approximation to the exact solution to the Couette flow problem for both large and small distances from the plates. The Rayleigh problem, the problem of an infinite wall oscillating in its own plane, and the steady-state sound propagation problem are studied. The method may be seen as an extension of fluid mechanics in that it produces a Chapman–Enskog expansion together with a correction term for effects due to the boundaries. Dissert. Abstr.

N71-27326 California Univ., Riverside.
GAUGE INVARIANCE IN THE THEORY OF SUPERFLUIDITY
Jack Serfatt (Ph.D. Thesis) 1969 63 p
Avail: Univ. Microfilms Order No. 70-11993

The hydrodynamic behavior of pure superfluid helium at zero degrees Kelvin is studied with a view toward gaining a clearer understanding of vortex nucleation, vortex core structure, backflow, the rotating superfluid, and film creep. An Ansatz which is reminiscent of the gauge invariance techniques encountered in quantum electrodynamics is used which gives a set of classical coupled nonlinear equations. The structure of the equations resembles that of a charged liquid in which density fluctuations play the role of charges. Consistency with hydrodynamics rules out radiative like solutions for the solenoidal flow field. The vorticity field in the vortex core is calculated, and the over simplified picture of a mathematical singularity given in earlier models is improved. Dissert. Abstr.

N71-27331# Oregon Univ., Eugene. Dept. of Physics.
VORTICITY IN SUPERFLUID HELIUM Final Report, 1 Jan. 1967–31 Dec. 1970
R. J. Donnelly 6 Feb. 1971 7 p refs
(Grant AF-AFOSR-1239-67)
(AD-720861; AFOSR-TR-71-0138) Avail: NTIS CSCL 20/13

The report details progress made during the period January 1, 1967 to December 31, 1970 on the problem of vorticity in superfluid helium. The report lists the research projects and resulting publications, and includes some publications on magnetohydrodynamics carried over from an earlier grant. Topics which were investigated included the structure, spatial arrangement, and nucleation of quantized vortices in helium 2. They include both theoretical and experimental studies. Author (GRA)

N71-27332* TRW Systems, Redondo Beach, Calif.
ELECTROHYDRODYNAMIC CONTROL VALVE Patent
Richard J. Salvinski and Owen O. Fiet, inventors (to NASA) Issued 16 Mar. 1971 5 p Filed 20 Aug. 1968 Cl. 137-81.5; Int. Cl. F15c1/04 Sponsored by NASA
(NASA-Case-NPO-10416; US-Patent-3,570,513; US-Patent-Appl-SN-754020) Avail: US Patent Office CSCL 20D

A control valve for switching a main stream of fluid from one stable position to another by electrohydrodynamic forces is described. The valve includes a first inlet for forming a jet of non-charged fluid and a plurality of fluid receiving apertures downstream from the inlet jet. The jet is selectively deflected toward one of the apertures by impressing an electric field of predetermined intensity along the length of the jet. The valve may further include at least one pair of oppositely diverging channels

disposed between the jet and the apertures. These channels are adapted to lock the flow of the jet along the wall thereof by means of the Coanda effect.
Official Gazette of the U.S. Patent Office

N71-27333# Aeronautical Research Associates of Princeton, Inc., N.J.
THEORETICAL AND EXPERIMENTAL STUDY OF THE DECAY OF ISOLATED VORTICES Progress Report, Feb. 1969–Feb. 1971
Coleman Du P. Donaldson, Roger D. Sullivan, and Richard S. Snedeker Feb. 1971 34 p refs
(Contract F44620-69-C-0089)
(AD-720852; ARAP-TM-71-2; AFOSR-TR-71-0733) Avail: NTIS CSCL 20/4

The report reviews the program in progress which is aimed at increasing an understanding of the decay of the trailing vortex systems behind aircraft. The program concerns a study of the effect of turbulent shear on the decay of a single vortex. The ultimate aim of the program is the development of a method by which the effects of turbulence, whether introduced initially in the center of a vortex or contained in the fluid in which the vortex is formed, could be calculated. The program consists of two parts. The first part is directed towards the development of analytical tools for the prediction of the effects of turbulence. The second part is an experimental program designed to obtain data against which the computational techniques may be checked. Author (GRA)

N71-27470# United Kingdom Atomic Energy Authority, Culham (England).
VORTEX: A 2-DIMENSIONAL HYDRODYNAMICS SIMULATION CODE
J. P. Christiansen Jul. 1970 41 p refs
(CLM-R-106) Avail: AEC Depository Libraries; HMSO 5s 6d; BIS $1.20

Program VORTEX is a computer code which simulates the behavior of an incompressible, inviscid homogeneous fluid in two dimensions by following the motion of a large number of point vortices. The theory behind the program and the program itself are described. NSA

N71-27601# Aeronautical Research Labs., Melbourne (Australia)
APPLICATION OF FINITE DIFFERENCE METHODS TO WHOLLY SUBSONIC AXISYMMETRIC AND PLANE FLOWS
M. P. Georgeff Sep. 1970 37 p refs
(ARL/A-326) Avail: NTIS

A method for computing a wide class of plane and axisymmetric potential flows is presented. The governing partial differential equations are generalized to incorporate separate transformation of each of the spatial coordinates. These equations are then expressed in finite difference form and solved using an iterative procedure. Quite simple transformations applied as suggested herein greatly improve the accuracy of the finite difference scheme. An analysis of the errors arising from the finite difference approximations and from the iterative procedure is presented. Results illustrating the method compare favourably with existing solutions. Author

N71-27602# Aeronautical Research Labs., Melbourne (Australia).
TURBULENT BOUNDARY LAYERS IN COMPRESSIBLE FLOW AND THEIR INTERACTIONS WITH NORMAL SHOCK WAVES: A SURVEY AND PROPOSED INVESTIGATION
W. H. Schofield Oct. 1970 36 p refs
(ARL/ME-321) Avail: NTIS

Work on the development of compressible turbulent boundary layers is reviewed. It appears that significant gaps exist in the available data and techniques for dealing with compressible turbulent boundary layers in zero pressure gradient; no detailed work was found which relates to the shock free supersonic adverse pressure gradient case. The separation of a supersonic boundary layer will probably differ markedly from that of the simpler incompressible layer. Normal shock wave boundary layer interaction is considered with particular reference to the instability problems of supersonic air intakes. A nondimensional grouping of variables is proposed with which it is hoped to characterize the behaviour of the post interaction flow in the subsequent subsonic adverse pressure gradients. A program of experimental work is proposed to determine the limits of interaction strength and subsonic pressure gradient necessary to retain fully attached flow in the subsonic diffuser. Author

N71-27608# Virginia Polytechnic Inst., Blacksburg. Dept. of Engineering Mechanics.
NUMERICAL SOLUTIONS TO THE VISCOUS SHOCK LAYER BLUNT BODY PROBLEM WITH INERT GAS INJECTION
R. E. Whitehead and R. T. Davis Albuquerque, N.Mex. Sandia Corp. Jan. 1971 124 p refs Prepared for Sandia Corp.
(SC-CR-70-6162) Avail: NTIS

A study was made of the effect of mass injection on the heat transfer and wall shear stress under reentry conditions. A set of equations for a binary mixture valid in the entire shock layer to second order in the inverse square root of a Reynolds number was found. A set of slip-flow boundary conditions which take into account mass transfer at the body surface was derived and used in the solution to the problem. Solutions were found for conditions at altitudes from 300,000 ft to 100,000 ft at a free-stream velocity of 20,000 fps. In all cases the body geometry was a hyperboloid asymptotic to a cone of total interior angle of 45 deg. Solutions were found for the injection of argon, helium, and air into air. Both equilibrium and frozen air models were used for the air species for which solutions were found for each case. A mass injection rate that decays exponentially from the stagnation point was used as well as different total mass transfer rates. Comparisons were made for different injection rates, different injectants, and for cases for both equilibrium and frozen air models. Author

N71-27651# General Electrical Co., San Jose, Calif. Atomic Power Equipment Dept.
TWO-PHASE FLOW AND HEAT TRANSFER IN MULTIROD GEOMETRIES: A STUDY OF THE LIQUID FILM IN ADIABATIC AIR-WATER FLOW WITH AND WITHOUT OBSTACLES
B. S. Shiralkar Oct. 1970 72 p refs
(Contract AT(04-3)-189)
(GEAP-10248) Avail: NTIS

An experimental study was made of a water film in a rectangular channel in air-water flow, in which two-phase parameters such as the film thickness and wall shear stress were measured. A photographic and quantitative study was also conducted on the phenomenon of film disruption due to various shapes of obstacles to simulate grid spacer contacts in multirod geometries. A simplified analysis of this phenomenon was made in terms of the moments of the air and water streams. Author

N71-27662*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ESTIMATION OF SHOCK LAYER THICKNESS AND PRESSURE DISTRIBUTION ON A DELTA WING-BODY SPACE SHUTTLE ORBITER
George E. Kaattari May 1971 22 p refs
(NASA-TM-X-62031) Avail: NTIS CSCL 20D

Methods are presented for calculation of both the shock inclination angle and the surface pressure coefficient in the vertical plane of symmetry of bodies at angle of attack. The methods are applicable over an angle of attack range from 0 deg to a maximum angle that depends on the body slenderness ratio; for very slender

bodies, this maximum angle of attack approaches 90 deg. The methods apply to configurations of elliptical cross section and of rectangular cross section with rounded corners. Author

N71-27675# ARO, Inc., Arnold Air Force Station, Tenn.
FREE-FLIGHT MEASUREMENTS OF SPHERE DRAG AT SUBSONIC, TRANSONIC, SUPERSONIC, AND HYPERSONIC SPEEDS FOR CONTINUUM TRANSITION, AND NEAR-FREE MOLECULAR FLOW CONDITIONS Final Report, 13 Nov. 1969 - 19 Jun. 1970
A. B. Bailey and J. Hiatt AEDC Mar. 1971 96 p refs
(Contract F40600-71-C-291)
(AD-721208; AEDC-TR-70-291) Avail: NTIS CSCL 20/4

A comprehensive set of measurements was made in a ballistic range which permits the sphere drag coefficient to be derived with an uncertainty of approximately + or - 2 percent in the flight regime 0.1 < M < 6.0 and 2 x 10 Re infinity < 10 to the 5th power for T sub W/T infinity approximately 1.0. Sufficient information is also presented to predict the effect of wall temperature on sphere drag coefficient when T sub W/T infinity does not equal 1.0 for < M infinity < 6. This investigation represents the most comprehensive experimental program to date to define sphere drag in the velocity-altitude regime applicable to the falling sphere technique for defining upper air density. GRA

N71-27768# Maryland Univ., College Park. Dept. of Physics and Astronomy.
TRANSPORT PROPERTIES OF FLUIDS NEAR CRITICAL POINTS
Jan V. Sengers Dec. 1970 156 p refs Sponsored in part by ARPA
(Contract N00014-67-A-0239-0014)
(AD-720718; TR-71-074) Avail: NTIS CSCL 7/4

The report reviews the situation concerning transport properties of fluids in the vicinity of critical points. Methods for measuring viscosity and thermal conductivity are examined and a critical assessment is presented of the experimental results. The paper covers the viscosity and thermal conductivity in binary liquid mixtures near the critical mixing point, in gases near the gas-liquid critical point and in liquid He I near the superfluid transition. The experimental results are interpreted in terms of current theoretical predictions. Author (GRA)

N71-27788# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF HEAT TRANSFER AND FRICTION ON FLOW PARAMETERS IN A NOZZLE WITH INDEPENDENT COOLING
V. E. Alemasov et al 9 Dec. 1970 16 p refs Transl. into ENGLISH from Aviats. Inst., Tr. (Kazan), no. 110, 1969 p 47-55
(AD-720933; FTD-MT-24-257-70) Avail: NTIS CSCL 20/4

A method is given for making calculations of the influence of heat transfer and friction on the flow parameters in a nozzle with independent cooling. The method cited was programmed for the Ural-4 computer and makes it possible to carry out calculations for gaseous working bodies which contain C, H, F, O, and N in their original composition. Author (GRA)

N71-27893# Oak Ridge National Lab., Tenn.
AIR FLOW TESTS IN VTE-X TUBE BUNDLE MODEL
R. Van Winkle Sep. 1970 65 p refs Sponsored by AEC
(ORNL-TM-3240) Avail: NTIS

Results of smoke tests, pressure measurements, and other experiments on the vertical tube evaporator are described. Smoke tests were done by injecting smoke into each pressure tap, and best results were obtained at low flow rates. Experiments on pressure profile measurement for estimating mass velocity distribution are discussed, and a probe is described for measuring impact pressure. The effects of low mass velocities on the efficacy of removing noncondensable gases from vertical tube bundles were investigated, and the pressure drops through the bundle were measured and compared to values calculated using recommended friction factor relationships. N.E.N.

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N71-28819# IBM Watson Research Center, Yorktown Heights, N.Y.
QUANTITATIVE PROPERTIES OF DELTA CHANNEL NETWORKS
J. Samuel Smart and Victor L. Moruzzi Jan. 1971 32 p refs
(Contract N00014-70-C-0188)
(AD-719918; TR-3) Avail: NTIS CSCL 8/8

Some simple procedures are developed for studying the topologic and geometric properties of delta distributary systems. A delta channel network has three kinds of vertices (forks, junctions, and outlets) and six kinds of links, each corresponding to one of the six possible combinations of upstream and downstream vertices. Various functions of the vertex and link numbers may be used to specify the topologic properties of the network. A particularly useful function is the recombination factor, or ratio of number of junctions to number of forks. This ratio varies from zero from networks with no recombination to unity for braided streams. A detailed topologic study of the networks of five natural deltas (Colville, Irrawaddy, Yukon, Niger, and Parana) shows recombination factors ranging from 0.5 to 0.85. The frequency of different kinds of links can be explained reasonably well be a simple model that assumes random connection of vertices. The link lengths for a given network appear to belong to a common distribution and to depend relatively little on location with respect to the coast. The results on the Parana suggest that it should be considered as two deltas in tandem, each with its characteristic recombination factor. Author (GRA)

N71-28843# Air Force Cambridge Research Labs., Bedford, Mass.
POLAR RIOMETER OBSERVATIONS
Raymond J. Cormier 3 Dec. 1970 21 p refs
(AD-721183; AFCRL-70-0690; AFCRL-ERP-344) Avail: NTIS CSCL 4/1

Qualitative descriptions of the morphology of Polar Cap Absorption (PCA) events are given, using data from the following riometer stations: Thule and Godhavn, Greenland; Churchill Range, Manitoba, Canada; and Reykjavik (Leirvogur), Iceland. The dependence of commencement time on solar zenith angle and subsequent daily variations in absorption following the initial day are described. The morphology of PCA events is very important for forecasting the behavior of ionospheric absorption during a PCA event. It is shown that besides information concerning the energy spectrum of the proton flux, the season and time of day must also be considered for forecasting the expected absorption. Author (GRA)

N71-28844# Air Force Cambridge Research Labs., Bedford, Mass.
RIOMETRY AS AN AID TO IONOSPHERIC FORECASTING
Raymond J. Cormier 10 Dec. 1970 31 p refs
(AD-721182; AFCRL-70-0689; AFCRL-ERP-343) Avail: NTIS CSCL 4/1

The report deals with the use of riometers as an aid in ionospheric forecasting during both disturbed and undisturbed conditions at various geographical regions of the earth. Both the

physical and technical aspects of riometry are discussed. Riometer observations during special solar geophysical events such as polar cap absorptions, auroral absorptions, and solar flare effects are presented and discussed. Suggestions for the improvement of riometer output and a description of experiments to be performed using riometers as an integral part of forecasting systems are presented. Author (GRA)

N71-26859# Joint Publications Research Service, Washington, D.C.

SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 251

28 Apr. 1971 48 p refs Transl. into ENGLISH from various Sino-Soviet bloc publications
(NPRS-52989) Avail: NTIS

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1. ASTRONOMY p 1–5 refs (See N71-26860 15-30).
2. METEOROLOGY p 6–11 refs (See N71-26861 15-20)
3. OCEANOGRAPHY p 12–17 refs (See N71-26862 15-13)
4. TERRESTRIAL GEOPHYSICS p 18–27 refs (See N71-26863 15-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 28–42 refs (See N71-26864 15-13)

N71-26862# Joint Publications Research Service, Washington, D.C.

OCEANOGRAPHY

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 251 28 Apr. 1971 p 12–17 refs (See N71-26859 15-13)
Avail: NTIS

News briefs, and abstracts of scientific articles concerning oceanography are presented. Topics include: large cylindrical dredge, T,S-analysis of waters off Nova Scotia, CO2 exchange between ocean and atmosphere, geomorphological and magnetometric studies in the Fijian Basin, and bioluminescence in ship wakes. F.O.F.

N71-26863# Joint Publications Research Service, Washington, D.C.

TERRESTRIAL GEOPHYSICS

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 251 28 Apr. 1971 p 18–27 refs (See N71-26859 15-13)
Avail: NTIS

News briefs, and abstracts of scientific articles concerning terrestrial geophysics are presented. Topics discussed include: mathematical models of the earth's crust, recurrence of geomagnetic storms, geological structure of the Southeastern Pacific Ocean, radioisotopes in water as earthquake precursor, and effect of high pressure and temperature on dielectric constant. F.O.S.

N71-26864# Joint Publications Research Service, Washington, D. C.

UPPER ATMOSPHERE AND SPACE RESEARCH

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 251 28 Apr. 1971 p 28–42 (See N71-26859 15-13) refs
Avail: NTIS

News briefs, and abstracts of scientific articles concerning upper atmosphere and space research are presented. The launching of Kosmos-402, 403, 404, and 405 were announced. Topics discussed include: optimum control of vehicles for space rescues, photographic observations of artificial satellites, detecting fluctuations in the upper atmosphere, and cooperation in satellite observations. F.O.S.

N71-26871# Joint Publications Research Service, Washington, D.C.

SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 250

16 Apr. 1971 51 p refs Transl. into ENGLISH from various Sino-Soviet bloc publications
(JPRS-52898) Avail: NTIS

CONTENTS:

1. ASTRONOMY p 1–6 refs (See N71-26872 15-30)
2. METEOROLOGY p 7–9 refs (See N71-26873 15-20)
3. OCEANOGRAPHY p 10–17 refs (See N71-26874 15-13)
4. TERRESTRIAL GEOPHYSICS p 18–26 refs (See N71-26875 15-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 27–41 refs (See N71-26876 15-13)

N71-26874# Joint Publications Research Service, Washington, D.C.

OCEANOGRAPHY

In its Soviet Bloc Res. in Geophys., Astronomy, and Space No. 250 16 Apr. 1971 p 10–kl 16 Apr. 1971 p 10–17 refs (See N71-26871 15-13)
Avail: NTIS

The return of the research ship, Vityaz, from its 49th voyage is announced, along with the proposed Soviet-French oceanogrphic conference and the instruments to be exhibited there. Poor equipment and organization in oceanographic research is cited. Abstracts of various oceanographic literature are also presented, including seismic studies of the ocean floor. J.A.M.

N71-26875# Joint Publications Research Service, Washington, D.C.

TERRESTRIAL GEOPHYSICS

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 250 16 Apr. 1971 p 18–26 refs (See N71-26871 15-13)
Avail: NTIS

Soviet news releases on earthquake prediction and computer analysis of seismic waves are reported. Abstracts of various geophysical literature are also presented, including elastic characteristic changes in rocks under pressure, the nature of Mohorovicic discontinuity, and tests of electrokinetic seismic pressure detectors at sea. J.A.M.

N71-26876# Joint Publications Research Service, Washington, D.C.

UPPER ATMOSPHERE AND SPACE RESEARCH

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 250 16 Apr. 1971 p 27–41 refs (See N71-26871 15-13)
Avail: NTIS

Ionospheric research and a study on propagation of visible and infrared waves in the atmosphere are outlined. The launchings of Cosmos 400 and 401 on 19 March 1971 and 27 March 1971, respectively, are announced. The activities of the Lunokhod 1 are reported, as well as research on cosmic ray modulation in interplanetary space. Abstracts of various atmospheric and aerospace literature are also presented, including geological-morphological analysis of Luna 17 landing region, polarization detection rays in solar flares, and a high altitude mass spectrometer experiment. J.A.M.

N71-26901# Joint Publications Research Service, Washington, D.C.

SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 252

14 May 1971 45 p refs Transl. into ENGLISH from various

Sino-Soviet bloc publications
(JPRS-53134) Avail: NTIS

CONTENTS:

1. ASTRONOMY p 1–4 refs (See N71-26902 15-30)
2. METEOROLOGY p 5–7 refs (See N71-26903 15-20)
3. OCEANOGRAPHY p 8–10 refs (See N71-26904 15-13)
4. TERRESTRIAL GEOPHYSICS p 11–15 refs (See N71-26905 15-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 16–41 refs (See N71-26906 15-13)

N71-26904# Joint Publications Research Service, Washington, D.C.

OCEANOGRAPHY

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 252 14 May 1971 p 8–10 refs (See N71-26901 15-13)
Avail: NTIS

A method for determining ocean current direction and velocity on the basis of an investigation of the temporal and spatial variability of surface temperature is described. The initial data used are synchronous maps which are now obtained using infrared thermometers carried aboard an aircraft or on an artificial earth satellite. The proposed method is somewhat similar to the method for studying currents by use of floats. In this case the role of floats is played by temperature inhomogeneities. The basis of the method is a study of the dynamics of temperature inhomogeneities. It must be taken into account that with time these temperature inhomogeneities are blurred due to turbulent diffusion and other factors. The estimate of the lifetime of an inhomogeneity influences the choice of scales of the studied phenomena in time and space. The method for determining current velocity is described in detail. The relative simplicity of obtaining the necessary initial data makes it possible to construct a map of currents over extensive areas and to study their temporal variability. Author

N71-26905# Joint Publications Research Service, Washington, D.C.

TERRESTRIAL GEOPHYSICS

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 252 14 May 1971 p 11–15 refs (See N71-26901 15-13)
Avail: NTIS

The important role of water in a number of tectonic processes is discussed. Investigations of the physics of shallow earthquakes both in the stages preceding faulting and at the moment of its occurrence and during the period of seismic wave propagation can no longer be limited exclusively to the solid phase of the rocks and it is essential to take into account the influence of the water filling rock pores and fissures. When there is an anomalously high pressure of pore water (hydrodynamic anomaly) in a hypocentral region of natural origin (or arising as a result of engineering activity) the importance of pore water as an active tectonic factor increases. Author

N71-26906# Joint Publications Research Service, Washington, D.C.

UPPER ATMOSPHERE AND SPACE RESEARCH

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 252 14 May 1971 p 16–41 refs (See N71-26901 15-13)
Avail: NTIS

Soviet plans and accomplishments in upper atmosphere and space research are presented. Subjects discussed are: (1) flights to other planets, (2) Kosmos 381 satellite, (3) review of Soviet Space achievements during last five years, (4) review of international space law, and (5) future Soviet space programs. Author

N71-27000# Paris Univ. (France).

INFLUENCE OF THE PLASMAPAUSE ON Pcl

F. Glangeaud and J. L. Lacoume 1970 14 p refs Presented at the Intern. Symp. on Solar-Terrestrial Phys., Leningrad, May 1970
Avail: NTIS

In the magnatosphere two magnetohydrodynamics modes of propagation are possible: one quite isotropic and the other strongly guided by the magnetic field. The observation of Pcl between conjugated points can be explained by this later mode. However the angle between the wave normal and the earth's magnetic field decreases continuously. When this angle theta tends to $-pi/2$ the approximation of the refractive index used is no longer valid. But in these conditions with a better approximation, it was found that the group velocity tends to 0 and so the propagation becomes impossible. It is shown that these difficulties can be overcome by taking into account the plasmapause. Two different plasmapause models are given. In the first the photon density decreases regularly between two lines of force limiting the plasmapause. In the second the plasmapause is supposed to be confined in one line of force which gives a discontinuity in the photon density profile. Author (ESRO)

N71-27019*# General Motors Research Labs., Warren, Mich.

A SHOCK WAVE STUDY OF COCONINO SANDSTONE

F. H. Shipman, V. G. Gregson, and A. Jones Washington NASA May 1971 50 p refs
(Contract NAS2-3427)
(NASA-CR-1842) Avail: NTIS CSCL 08K

Hugoniot equation of state measurements to 1400 kb were made on Coconino sandstone. The data is summarized with other quartz shock wave and used to estimate isotherms for the three solid phases of quartz, coesite and stishovite. Calculations of shock temperature have been made based on these isotherms and lead to an estimation of the phase boundaries of quartz polymorphs under dynamic loading. The dynamic phase boundaries are shown to shift significantly compared to those determined statically. Author

N71-27025*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

AN EVALUATION OF EARTH RESOURCES OBSERVATION OPPORTUNITIES FROM AN ORBITING SATELLITE

E. H. Bauer and B. S. Perrine 19 May 1971 88 p refs
(NASA-TM-X-64598) Avail: NTIS CSCL 08G

The National Aeronautics and Space Administration is currently engaged in integrating, on the Skylab workshop, an Earth Resources Experiment Package (EREP) which will be exercised by each of three separate flight crews in the 1973 time frame. Other continuously manned missions which include an EREP are in the planning phase. For effective mission planning, a knowledge of the opportunities for experiment performance and of the interdependence of experiment requirements and systems constraints is mandatory. The development and application is discussed of a new mission analysis simulation technique designed to evaluate and optimize these opportunities. Factors influencing available opportunities, such as orbital parameters, solar lighting at the target, system limitations, etc., are incorporated in the simulation and analyzed to determine their effects. The USA is considered the prime target with either USA coverage time or the number of passes over the USA used as a payoff function. Optimization for various mission parameters, such as orbital inclination, launch time, and launch date, are included. The 50 deg inclined circular orbit at 435 km altitude is analyzed in depth. USA coverage time and number of passes for missions in this orbit, such as Skylab and possibly the shuttle sortie missions, are provided. Author

N71-27028# Istituto di Fisica dell'Atmosfera, Rome (Italy).

SOME CALCULATIONS OF THE THERMAL BALANCE FOR

THE TYRRHENIAN SEA (MAY 1969) [ALCUNI ESEMPI DI CALCOLO DEL BILANCIO TERMICO PER IL MAR TIRRENO (MAGGIO 1969)]
M. Colacino and E. Rossi Dec. 1969 69 p refs In ITALIAN
(IFA-SR-29) Avail: NTIS

The results obtained during 1969 for the measurement of the heat balance of the Tyrrhenian sea are presented. Definition is given of the various terms of the balance, i.e. of the heat generated by thermodynamic, chemical and physical processes, the heat absorbed by the solar radiation or produced by radioactive processes, and of the heat lost by the earth through irradiation, convection, evaporation, and other processes. The instrumentation used is described and the data are presented in tables and diagrams and compared with those obtained by the Royal Dutch Meteorology. The possible errors are pointed out together with the meteorological factors that can have an influence on the results. ESRO

N71-27027# Bochum Univ. (West Germany). Bereich Extraterrestrische Physik in der Abteilung 12.
AN EXPERIMENT FOR THE EXPANSION OF ARTIFICIAL STRONTIUM VAPOR CLOUDS IN THE HIGH ATMOSPHERE AND MODEL CALCULATION ON THE RADIATION TRANSPORT IN THE DIFFUSION PHASE OF SUCH CLOUDS [EIN EXPERIMENT ZUR EXPANSION KUENSTLICHER STRONTIUMDAMPFWOLKEN IN DER HOCHATMOSPHAERE UND MODELLRECHNUNGEN ZUM STRAHLUNGSTRANSPORT IN DER DIFFUSIONSPHASE DIESER WOLKEN]
H. M. Kappler Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Mar. 1971 107 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-71-10) Avail: NTIS; ZLDI Munich: 22,50 DM

During a rocket experiment (March 16th, 1969) strontium vapor clouds were released at altitudes of 167, 200, and 230 km. The emission of the resonance line (4607 A) of the strontium atoms was stimulated by the solar radiation. For the registration of these clouds, an electronically controlled camera driving system was developed and built up. The cloud at 230 km showed a ring shaped distribution of brightness, which was caused by a density distribution of particles with a relative minimum in the center of the cloud. In order to derive the diffusion coefficients from the observed expansion of the clouds, the distribution of the surface brightness was calculated for optical thick clouds with Gaussian density distributions. This radiation transport problem was treated with the help of the Monte Carlo method, under consideration of multiple scattering. Author (ESRO)

N71-27030# Rome Univ. (Italy). Lab. di Astrofisica.
THE PAST AND PRESENT FALL OF COSMIC MATERIALS ON THE EARTH [LA CADUTA SUL GLOBO TERRESTRE DI MATERIALE DI ORIGINE COSMICA NEL PASSATO E NEL PRESENTE]
Felice Di Benedetto Nov. 1969 28 p refs In ITALIAN
(Rept-69/18) Avail: NTIS

A review is presented of the various origins of the fallout of cosmic materials on the earth's surface. The hypothesis that meteors can be considered a source of cosmic materials is stressed. The aspect of cosmic dust deposits, in particular the frequency of small sphere-shaped aggregates (spherulae) is described, together with the structure of the meteoric materials found on the earth's surface. ESRO

N71-27031# Institut Royal Meteorologique de Belgique, Brussels.
OZONE OBSERVATIONS Quarterly Bulletin No. 4, 1968 [OBSERVATIONS D'OZONE Bulletin Trimestriel No. 4, 1968]
1971 47 p In FRENCH and DUTCH
Avail: NTIS

An atmospheric cooperative ozone sounding program using Brewer-Mast probes has been carried out between the Belgian Royal Meteorological Institute, the Laboratorium fuer Atmosphaerenphysik, E.T.H. Zurich, the Institut fuer Meteorologie und Geophysik der Freien University, Berlin, and the Meteorologisches Observatorium, Hohenpeissenberg. This report deals with the measurements made by the Belgian group during the last quarter of 1968. ESRO

N71-27054# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LASER RANGEFINDING. PARTICIPATION OF ONERA TO GEODESY OPERATIONS THROUGH DIADEME SATELLITES [LA TELEMETRIE LASER. PARTICIPATION DE L'ONERA AUX OPERATIONS DE GEODESIE AU MOYEN DES SATELLITES DIADEME]
Roland Moreau and Claude Veret 1969 49 p refs In FRENCH; ENGLISH summary Sponsored by Direc. Rech. et Moyens d'Essais
(ONERA-NT-156) Avail: NTIS

A mobile station of laser rangefinding has been designed and built at ONERA; it has been operated in 1967 at Colomb-Bechar (South West Algeria) in order to take part in geodetic experiments through the DIADEME satellites, under the sponsorship of CNES (the French Space Agency) and DRME (Research Department of the Defence Ministry). The interest of laser, as compared to that of radio frequency radars, is shown; then the various parts of a laser rangefinder are examined in detail: optical transmitter-receiver device, electronic circuits for measurements and dating, consequencies of the use of retroreflectors (cube corners) on the target. The measuring station used for the geodesy experiments is described, as well as the results obtained. Lastly are examined the improvements that could be applied to the equipment to augment the maximum range or the accuracy, and various other fields of application are mentioned. Author (ESRO)

N71-27062# Istituto di Fisica dell'Atmosfera, Rome (Italy).
ORGANIZATIONAL SCIENTIFIC AND DIDACTIC ACTIVITY OF THE INSTITUTE OF ATMOSPHERIC PHYSICS. FINANCIAL YEAR 1969 [RELAZIONE SULL ATTIVITA ORGANIZZATIVA SCIENTIFICA E DIDATTICA DELL'IFA. ESERCIZIO FINANZIARIO 1969]
Feb. 1970 136 p refs In ITALIAN
(IFA-TR-29) Avail: NTIS

The Istituto di Fisica dell'Atmosfere (IFA) formerly called CENFAM, was founded in 1968. IFA presents the budget for 1969 financial year together with a summary of the scientific, didactic, and organizational activities of the Institute in the field of atmospheric physics. In particular the activities of IFA concerned meteorology, microphysics of the atmosphere, high atmospheric studies, aeronomy magnetosphere, electricity, radioactivity, and optics in the atmosphere. ESRO

N71-27063# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany).
MEASUREMENTS OF ELECTRIC FIELDS IN EQUATORIAL AND MEDIUM LATITUDES DURING TWILIGHT USING BARIUM ION CLOUDS
E. Rieger Sep. 1970 19 p refs
(MPI-PAE/Extraterr-49/70) Avail: AEC Depository Libraries

Measurements of the ionospheric electric field at low and medium magnetic latitudes, using barium ion clouds, are summarized. The measured field strengths range from 0.3 to about 4.0 V/km. The field vectors are pointing preferentially southward during evening twilight and northward during morning twilight on the northern hemisphere at midlatitudes. At the equator, the vertical component exceeds the horizontal by a factor of about 3. Here the drifts are west and upward in the evening and east and downward in the morning. The implications of the observations on the Sq current are discussed, and evidence for the dynamo action of the atmosphere is derived in some cases, preferentially evening experiments. At the geomagnetic equator the ionospheric current

appears to be driven by the electric polarization field. Author (NSA)

N71-27187# Alaska Univ., College. Geophysical Inst.
TYPES Pc 1-2 AND IPDP MICROPULSATIONS AT THE AURORAL ZONE Final Report, 1 Nov. 1967 – 31 Oct. 1970
Richard R. Heacock Jan. 1971 131 p refs
(Contract F19628-68-C-0121)
(AD-721200; UAG-R-215; AFCRL-71-0097) Avail: NTIS CSCL 4/1

A micropulsation recording program was carried out at College and Anchorage, Alaska and at Bar I, Canada, with induction magnetometers. The analysis program centered mainly on synoptic and polarization characteristics for types Pc 1-2, IPDP, and Pi burst micropulsation events. Summaries of the known morphological features for structured Pc 1 and structured Pc 1-2 micropulsations are given. The synoptic studies disclosed latitude relationships between unstructured Pc 1-2, IPDP, and Pi burst events. At the onset of a polar substorm, Pi bursts occur near midnight at 65 degrees - 70 degrees geomagnetic latitudes. IPDP events follow the Pi burst and are seen in evening hours at 60 degrees - 65 degrees latitudes. IPDP events seen in afternoon hours are often preceded by unstructured Pc 1-2 activity which maximizes a few degrees polewards of the IPDP. The IPDP events are seen in the evening bulge region of the plasmasphere. The proton plasma requirement for IPDP wave generation suggests that protons which are injected near midnight in the Pi burst event drift westwards into the bulge and generate unstructured Pc 1-2 and IPDPs there. Author (GRA)

N71-27188# Utah State Univ., Logan. Electro-Dynamics Labs.
AIRBOURNE AIRGLOW STUDIES Final Report, 30 Jun. 1967 – 31 Oct. 1970
Allan J. Steed, Ron J. Hupp, Ralph H. Haycock, and Doran J. Baker 31 Oct. 1970 16 p Sponsored in part by DASA
(Contract F19628-67-C-0399)
(AD-720873; AFCRL-70-0666) Avail: NTIS CSCL 4/1

During the past three years personnel from Electro-Dynamics Laboratories and Stewart Radiance Laboratory of Utah State University have supported AFCRL personnel in successfully obtaining atmosopheric infrared emission spectra aboard a KC-135 aircraft. Data were obtained using an Interferometer System and an NIR Radiometer System. These systems have been maintained, updated, evaluated, and calibrated throughout the contract period. In addition, a highspeed, nitrogen-cooled, radiation chopper system has been designed, fabricated and installed to make the desired infrared measurements possible. A set of vibration isolation platforms to accommodate the interferometers in the aircraft was also developed and installed. Author (GRA)

N71-27216# Lamont Geological Observatory, Palisades, N.Y.
INVESTIGATION OF ATMOSPHERIC PRESSURE WAVES FROM NUCLEAR EXPLOSIONS Final Report, 1 Dec. – 30 Nov. 1970
Thomas J. Herron and William L. Donn 20 Jan. 1971 51 p refs
(Contract F44620-70-C-0019)
(AD-720853; AFOSR-TR-71-0613) Avail: NTIS CSCL 4/1

Atmospheric gravity waves generated by low-altitude nuclear explosions have been detected by ground-level microbarographs and by ionospheric instruments. Group velocity dispersion curves have been computed for propagation over the short and long great-circle paths. Apparent lower velocities over the short paths are interpreted as due to the rise time of the nuclear disturbances to ionospheric levels with subsequent generation of gravity waves at those levels. Corrections to travel times to account for the rise time delays are estimated to be about 13 min or more. Corrected group velocity dispersion curves are found to agree with theoretical group velocity dispersion for atmospheric surface waves. The spatial coherence of 1-5 min acoustic waves from two nuclear explosions is presented along with atmospheric pressure background noise for the same period band. The spatial coherence of the waves from both explosions is greater than the noise coherence at station separations greater than 6-10 km. Author (GRA)

N71-27273 Pittsburgh Univ., Pa.
A PHOTOMETRIC MEASUREMENT OF THE VERTICAL DISTRIBUTION OF HELIUM AND SOME DEVELOPMENT OF THE SUPPORTING RADIATIVE TRANSFER THEORY
John Berg Kumer (Ph.D. Thesis) 1969 223 p
Avail: Univ. Microfilms Order No. 70-12841

The overhead intensity of the 584A resonance line of helium in the day air glow was measured as a function of height between 400 km and 1000 km on July 12, 1966 by a retarding potential analyzer that was mounted on a rocket launched from Wallops Island, Virginia. Essentially the measuring technique involved analyzing the energy spectrum of photoelectrons produced by ultraviolet skylight. The radiative transfer theory supporting the analysis of the experiment is developed in detail. The comparison of the experimental 584A intensity profile with theoretical profiles showed the best fit for the total resonance optical thickness above 185 km to be approximately 10, corresponding to a column density of Helium above 185 km equal to 8.6 × 10 to the 13th power/sq cm. Within the bounds of experimental error the measured Helium number density distribution was identical to that predicted by assuming diffusive equilibrium. Upper and lower limits were found for the half width of the solar 584A emission line. Dissert. Abstr.

N71-27307 Wisconsin Univ., Madison.
A STUDY OF THE ATMOSPHERIC ENERGY TRANSPORT OVER NORTH AMERICA
Elford George Astling (Ph.D. Thesis) 1970 114 p
Avail: Univ. Microfilms Order No. 70-8259

The poleward energy transport was calculated from radiosonde data over the North American continent for three winter months. The large scale atmospheric motions were partitioned into four circulation modes, mean and transient meridional circulations and stationary and transient eddy circulations, and the poleward energy transport by each mode was calculated. The transport was also partitioned according to four energy forms – sensible heat, latent heat, geopotential energy, and kinetic energy. The energy fluxes accomplished by various large scale synoptic transient eddies were also studied. The importance of various large scale synoptic features in contributing to the poleward energy transport by transient eddies was investigated. It was found that wave shape played a significant role in determining the effectiveness of the transport. Dissert. Abstr.

N71-27471# Adelaide Univ. (Australia). Dept. of Physics.
MEDIUM FREQUENCY IONOSPHERIC AND METEOR OBSERVATIONS USING A LARGE ANTENNA ARRAY Final Report
Basil H. Briggs Mar. 1971 11 p
(Grant AF-AFOSR-0864-67)
(AD-721223; AFOSR-TR-71-0543) Avail: NTIS CSCL 4/1

An array of 80 dipoles is employed to study radio signals reflected and scattered from ionospheric irregularities and meteor trails in order to determine changes and drifts in ionospheric irregularities and wind gradients at high altitudes. Author (GRA)

N71-27474# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
SEISMIC COMPRESSION WAVES ASSOCIATED WITH UNDERGROUND NUCLEAR EXPLOSIONS IN THE SAHARA [ONDES SEISMIQUES DE COMPRESSION LIEES AUX EXPLOSIONS NUCLEAIRES SOUTERRAINES DU SAHARA]
Henri Ferrieux Nov. 1970 41 p refs In FRENCH

(CEA-R-4105) Avail: NTIS

A theoretical analysis was made on the generation of compression seismic waves. The influence of the various parameters (medium and explosion conditions) on the amplitude of the waves is demonstrated. Experimental results on the Sahara underground nuclear explosions are compared with the theoretical considerations. Author (NSA)

N71-27479# Sandia Corp., Albuquerque, N.Mex.

SEISMIC WAVES FROM FINITE BURIED SOURCES IN THE ELASTIC EARTH

Frederick Norwood and John Wu Dec. 1970 38 p refs Sponsored by AEC

(SC-DR-70-836) Avail: NTIS

The exact response of the elastic earth to loads located in a plane parallel to the bounding surface is determined. The solution is found for an arbitrary source and then specialized to a source on half of the loading plane. In this case exact velocities at the bounding surface are given, for arbitrary values of Poisson's ratio, in terms of closed form algebraic expressions. In addition, solutions are given for the velocities in the interior of the half-space. An outline is provided for extending the present work to other loading geometries. Author

N71-27484 World Meteorological Organization, Geneva (Switzerland).

RADIATION INCLUDING SATELLITE TECHNIQUES

1970 588 p refs Proc. of the WMO/IUGG Symp., Bergen, Aug. 1968

(WMO-248-TP-136; TN-104) Copyright. Avail: Issuing Activity

Conference papers on solar radiation, spectroscopy, instrumentation, and radiation climatology are presented. For individual titles see N71-27485 through N71-27565. ESRO

N71-27487 Oxford Univ. (England). Clarendon Lab.

THE MEASUREMENT OF SATELLITE WEIGHTING FUNCTIONS IN THE 15 MU BAND OF CARBON DIOXIDE

P. G. Abel *In* WMO Radiation Including Satellite Tech. 1970 p 11-16 ref (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

The measurement of the atmospheric black body weighting functions of the selective chopper radiometer (SCR) on Nimbus D is dealt with. The radiometer collects energy emitted by the atmosphere in the 15 micron band of carbon dioxide which is uniformly mixed in the atmosphere at heights below 70 km. Its purpose is to measure the temperature profile from the ground to a height of 50 km. A special feature is the use of carbon-dioxide-filled cells as filters. ESRO

N71-27488 World Meteorological Organization, Geneva (Switzerland).

DENSITY MEASUREMENT WITH RADIO-WAVE OCCULTATION TECHNIQUE

B. B. Lusignan *In its* Radiation Including Satellite Tech. 1970 p 17-19 (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

The use of satellites for earth atmosphere density measurement by microwave radio occultation is discussed. The accuracy of the pressure measurements at different heights and the influence of the presence of water vapor at low altitude in the atmosphere are analyzed. ESRO

N71-27491 National Environmental Satellite Center, Washington, D. C.

INDIRECT MEASUREMENTS OF CLOUD-TOP ALTITUDES

D. Q. Wark *In* WMO Radiation Including Satellite Tech. 1970 p 45-47 refs (See N71-27484 15-13)

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It has been suggested that measurement of cloud reflectance in the 0.75 micron band of oxygen could be used to determine the cloud-top heights. Results of nineteen observations of verified cloud tops are discussed. The ratio of apparent pressure altitude of clouds to the true pressure is analyzed as is the profile of cloud altitude measurements of an isolated cumulus congestis cloud. ESRO

N71-27492 Polytechnic Inst. of Brooklyn, Farmingdale, N. Y. Aerospace Dept.

RE-EVALUATION OF THE EARTH'S RADIANCE AT 2.2 MICRONS

Ralph Zirkind *In* WMO Radiation Including Satellite Tech. 1970 p 49-54 refs (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

Observation data on earth and cloud radiance at 2.2 microns from the Gemini 5 flight are analyzed and the observed spread in spectral radiance is explained. ESRO

N71-27494 Leningrad (A. A. Zhdanov) State Univ. (USSR).

THE CLIMATOLOGY OF THE NET RADIATION OF THE EARTH AT THE PRESENT STAGE

K. Y. Kondratyev, L. N. Dyachenko, and K. Y. Vinnikov *In* WMO Radiation Including Satellite Tech. 1970 p 59-65 refs Prepared jointly with Main Geophys. Obs. (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

Available computational and experimental data on the climatology of the net radiation of the earth are discussed. ESRO

N71-27495 National Environmental Satellite Center, Washington, D. C. Radiation Branch.

STATISTICAL ESTIMATION OF THE ATMOSPHERE'S TEMPERATURE AND PRESSURE-HEIGHT DISTRIBUTION FROM SATELLITE RADIATION MEASUREMENTS

W. L. Smith *In* WMO Radiation Including Satellite Tech. 1970 p 71-72 (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

A statistical method based on theoretical considerations is formulated for interfering temperatures and geopotential height distribution of the atmosphere from the 15 microns spectral radiances to be obtained from the Nimbus 3 satellite. ESRO

N71-27496 Oxford Univ. (England). Clarendon Lab.

THE INVERSION PROBLEM IN THE PRESENCE OF CLOUD

C. D. Rodgers *In* WMO Radiation Including Satellite Tech. 1970 p 73-77 refs (See N71-27484 15-13)

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In recent years it has become evident that the most appropriate method of deducing the atmospheric temperature profiles from satellite measurements of radiation must use statistical information. The presence of cloud in the atmosphere and the difficulties it creates are discussed. ESRO

N71-27498 World Meteorological Organization, Geneva (Switzerland).

RADIATION OF WATER VAPOUR AT AN ALTITUDE OF 60 TO 120 km

M. N. Markov *In its* Radiation Including Satellite Tech. 1970 p 85-88 refs (See N71-27484 15-13)

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The angular distribution of radiation of the free atmosphere using geophysical rockets (Cosmos 45 and Cosmos 65) is investigated. The comparison of the radiating atmosphere height with earth humidity showed that the height of the atmosphere is directly proportional to the concentration of water vapor near the earth's surface. ESRO

N71-27499 World Meteorological Organization, Geneva (Switzerland).
INFRA-RED RADIATION OF MOLECULES IN THE IONOSPHERE
M. N. Markov *In* WMO Radiation Including Satellite Tech. 1970 p 89–93 refs (See N71-27484 15-13)
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Satellites and rocket data on the infrared radiation of the ionosphere are analyzed. It appears that the intensity of radiation at an altitude of from 100 to 150 km is distributed nonuniformly. ESRO

N71-27500 World Meteorological Organization, Geneva (Switzerland).
DETERMINATION OF THE SURFACE AND CLOUD TEMPERATURE BY MEASUREMENTS OF THE EARTH'S RADIATION IN THE 8–12 MICRONS WINDOW BY THE SATELLITE COSMOS 149
A. K. Gorodetsky and M. S. Malkevich *In its* Radiation Including Satellite Tech. 1970 p 95–99 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

The IR-radiometer of Cosmos 149 which measured the thermal radiation of the earth in the from 8 to 12 microns range has been used for the determination of surface or cloud temperature. The reliability of the measurements and the assessment of temperatures are discussed. ESRO

N71-27502 World Meteorological Organization, Geneva (Switzerland).
APPLICATION OF STATISTICAL METHODS FOR DETERMINING THE VERTICAL TEMPERATURE PROFILE FROM MEASUREMENTS OF THE EARTH'S RADIATION BY SATELLITES
V. F. Tourchin, M. S. Malkevich, and V. P. Kozlov *In its* Radiation Including Satellite Tech. 1970 p 111–116 refs (See N71-27484 15-13)
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The problem of measuring the earth radiation in some spectral intervals and of determining the vertical temperature profile of the atmosphere is reduced to an inversion of an integral equation linearized according to the atmosphere. The solution of this equation is given by the method of statistical regularization. This method is described as well as its application to the problem of the determination of the atmospheric temperature. ESRO

N71-27503 Michigan Univ., Ann Arbor. High Altitude Engineering Lab.
ABSORPTION BY THE 15 MICROMETER BANDS OF CARBON DIOXIDE
S. R. Drayson *In* WMO Radiation Including Satellite Tech. 1970 p 123–125 refs Sponsored by Natl. Environ. Satellite Lab., ESSA (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

Parameters of the carbon dioxide bands between 12 and 18 microns are fairly well known. Some discrepancies occur which have to be explained. The obtention of transmittances from the band parameter-line positions, intensities, and half-widths by direct integration with respect to frequency is discussed. Effects of atmospheric temperature variations, water vapor, and ozone are analyzed. ESRO

N71-27504 Tomsk State Univ. (USSR). Inst. of Technical Physics.
A THEORETICAL STUDY OF THE ABSORPTION BAND BOUNDARIES OF ATMOSPHERIC GASES
V. E. Zuev, I. I. Ippolitov, and Y. S. Makushkin *In* WMO Radiation Including Satellite Tech. 1970 p 133–137 ref (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

The algorithms for calculation of the central positions, intensities, and half-widths of vibration-rotational lines in the spectrum of water vapor have been described taking into account the non-rigidity of the molecules. The difference is found out of the line parameter values obtained in the calculation following the proposed method and using the rigid rotor model. Results obtained with the two methods are tabulated. ESRO

N71-27505 Leningrad (A. A. Zhdanov) State Univ. (USSR).
NUMERICAL EXPERIMENTS ON STUDYING TRANSMISSION FUNCTIONS OF ATMOSPHERIC GASES
K. Y. Kondratyev and Y. M. Timofeev *In* WMO Radiation Including Satellite Tech. 1970 p 139–144 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

The transmission functions of the 15 microns carbon dioxide band as well as the water vapor rotational band is discussed. Special attention was paid to the study of peculiarities in the infrared radiative transfer in the spectral intervals used for thermal atmospheric sounding. ESRO

N71-27507 World Meteorological Organization, Geneva (Switzerland).
ON THE CALCULATION OF THE ATMOSPHERIC OXYGEN ABSORPTION SPECTRUM AND CONSTRUCTION OF THE GROWTH CURVE
A. G. Pokrovsky and A. K. Suslov *In its* Radiation Including Satellite Tech. 1970 p 155–159 refs (See N71-27484 15-13)
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Theoretical profiles of the oxygen absorption lines have been plotted and their comparison with observed data at large dispersion are presented. The influence of stratification in the atmosphere was also investigated. For this, the extreme atmospheric stratifications (winter arctic and tropical atmospheres) were taken. ESRO

N71-27509 World Meteorological Organization, Geneva (Switzerland).
DETERMINATION OF THE ABSORPTION FUNCTION OF OZONE BANDS WITH THE CONSIDERATION OF THEIR FINE STRUCTURE
A. P. Galtsev and V. M. Osipov *In its* Radiation including Satellite Tech. 1970 p 165–169 refs (See N71-27484 15-13)
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The quasi-stationary model and a modified statistical model for the real line intensity consistent with each other. ESRO

N71-27513 Swiss Inst. of Meteorology, Zurich.
ON THE DIFFUSE IRRADIANCE OF NON-HORIZONTAL PLANE SURFACE
P. Valko *In* WMO Radiation Including Satellite Tech. 1970 p 191–195 Submitted for publication (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

In respect of non-horizontal plane surfaces only the direct solar component of the total short-wave flux can be computed exactly. The diffuse component can be determined from measurements of direct sun intensity taking into account the atmospheric turbidity, the angular height, azimuth of the sun, and azimuth and inclination of the irradiated surface. The main results obtained are summarized. ESRO

N71-27515 Arctic and Antarctic Scientific Research Inst. (USSR).
RADIATION REGIME OF THE ARCTIC
N. T. Chernigovskiy and M. S. Marshunova *In* WMO Radiation Including Satellite Tech. 1970 p 209–212 (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

The most important characteristics of radiation balance of the Arctic regions are discussed. Different types of radiation regimes of sea and land surfaces are defined. ESRO

N71-27516 Norwegian Meteorological Inst., Blindern.
GLOBAL RADIATION IN NORTHERN NORWAY AND SPITSBERGEN
Gunnar Spinnangr *In* WMO Radiation Including Satellite Tech. 1970 p 213–215 (See N71-27484 15-13)
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Running observations of global radiation started over northern Norway and Spitsbergen in 1950 using pyranometers. Calibration of two kinds of instrument is discussed. Annual variations of the mean daily global and relative global radiation are indicated on graphs. ESRO

N71-27522 Leningrad (A. A. Zhdanov) State Univ. (USSR).
AEROSOL STRUCTURE OF THE TROPOSPHERE AND STRATOSPHERE
K. Y. Kondratyev, I. Y. Badinov, L. S. Ivlev, and G. A. Nikolsky *In* WMO Radiation Including Satellite Tech. 1970 p 243–247 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

Vertical profiles of aerosol concentration, size distribution of particles, chemical composition, and optical characteristics in the stratosphere have been considered. A review of the results is presented. ESRO

N71-27523 Rand Corp., Santa Monica, Calif.
SCATTERING AND ABSORPTION PARAMETERS OF CLOUDS AND DUSTS
D. Deirmendjian *In* WMO Radiation Including Satellite Tech. 1970 p 249–250 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

New results on the theoretical primary scattering and absorption properties of polydispersed clouds and dusts are described. Five new models, corresponding to continental and stratospheric aerosols, corona producing and mother-of-pearl clouds, as well as substances such as silicates, clay, and iron are included. ESRO

N71-27526 Meteorologisches Observatorium, Dresden (East Germany).
ON THE AEROSOL FACTOR IN THE TWILIGHT METHOD
G. Dietze *In* WMO Radiation Including Satellite Tech. 1970 p 269–270 (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

It used to be assumed that the aerosol in the troposphere is of noticeable influence only during the bright twilight phase. It now appears that the entire middle twilight phases are strongly influenced by troposphere turbidity. Three approaches for an interpretation of this effect are critically examined. The varying accumulation of aerosols in the region near the mesopause is also discussed. ESRO

N71-27527 Mainz Univ. (West Germany). Inst. of Meteorology.
INFLUENCE OF THE ATMOSPHERIC AEROSOL ON THE ELLIPTICAL POLARIZATION OF SKYLIGHT
Reiner Eiden *In* WMO Radiation Including Satellite Tech. 1970 p 275–278 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

Elliptical polarization of skylight by atmospheric erosols can only be expected in very turbid atmospheres since in a prevailing molecular atmosphere only linear polarization is possible. Elliptical polarization can only be expected in higher order scattering processes. The physical explanation of measurements carried out in an industrial polluted area is discussed. ESRO

N71-27528 Mainz Univ. (West Germany). Inst. of Meteorology.
DIURNAL VARIATION OF SKYLIGHT AND SKYLIGHT POLARIZATION
Elisabeth de Bary *In* WMO Radiation Including Satellite Tech. 1970 p 279–281 refs (See N71-27484 15-13)
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Results of measurements carried out on diurnal variations of skylight and skylight polarization in the Canary Islands are reported. The physical meaning of these results is discussed. ESRO

N71-27529 World Meteorological Organization, Geneva (Switzerland).
LIGHT SCATTERING AND AEROSOL
G. V. Rozenberg *In its* Radiation Including Satellite Tech. 1970 p 285–287 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

Results of a complex optical experiment containing about a quarter of a million very fine measurements are presented. The role of aerosols as an optical and radiation factor is analyzed on the basis of a physical analysis of laws peculiar to different types of optical phenomena. ESRO

N71-27530 World Meteorological Organization, Geneva (Switzerland).
THE AEROSOL CONCENTRATION WITHIN DIFFERENT LAYERS OF THE ATMOSPHERE AS DERIVED FROM OPTICAL AND PYRHELIOMETRIC MEASUREMENTS
Anders Angstroem *In its* Radiation Including Satellite Tech. 1970 p 289–290 (See N71-27484 15-13)
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A classification of the atmosphere according to the aerosol conditions and the value of aerosol concentration at various altitudes obtained by pyrheliometric and searchlight measurements are discussed. The effects of eddy convectivity are analyzed. ESRO

N71-27531 Pembroke Coll., Oxford (England).
CALCULATIONS OF INFRARED RADIATION EMERGING FROM THE EARTH'S ATMOSPHERE IN THE PRESENCE OF CIRRUS CLOUD
I. P. Grant and G. E. Hunt (Atlas Computer Lab.) *In* WMO Radiation Including Satellite Tech. 1970 p 295–297 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

The most serious limitation in measuring the global atmospheric temperature distribution by remote sensing in the infrared is the influence of clouds. Theoretical effects of cirrus clouds on thermal emission vertically upwards at wavelengths from 8 to 150 microns are presented. ESRO

N71-27533 Lille Univ. (France).
COMPARATIVE THEORETICAL AND EXPERIMENTAL STUDIES OF SCATTERING RADIANCE IN A PLANE-PARALLEL MEDIUM
C. Devaux, J. C. Guillemot, and J. Marengo *In* WMO Radiation Including Satellite Tech. 1970 p 305–309 refs (See N71-27484 15-13)
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Visible and infrared transfer in cloud is considered and laboratory measurements are compared with theory. The equations are numerically solved using the method of spherical harmonics. The method can solve the problem of anisotropic scattering with a good approximation. ESRO

N71-27535 Leiden Univ. Observatory (Netherlands).
MULTIPLE ANISOTROPIC SCATTERING OF UNPOLARIZED AND POLARIZED LIGHT IN CLOUDS
J. W. Hovenier *In* WMO Radiation Including Satellite Tech.

1970 p 319–323 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

The multiple scattering of polarized light on plane parallel homogeneous cloud layer is analyzed. A doubling method for polarized light is proposed. ESRO

N71-27536 Leningrad (A. A. Zhdanov) State Univ. (USSR).
LIGHT SCATTERING IN THE AEROSOL SPHERICAL ATMOSPHERE
O. I. Smokty *In* WMO Radiation Including Satellite Tech. 1970 p 325–328 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

The theoretical analysis of the scattered radiative field in the aerosol spherical atmosphere and the interpretation of the corresponding experimental data rely at present only on approximation. The calculation of the night horizon brightness of the real atmosphere is carried out. The calculation shows the essential influence of the atmospheric ozone on the absolute brightness value and on the twilight sky color. ESRO

N71-27537 Mainz Univ. (West Germany). Inst. of Meteorology and Geophysics.
VARIATION OF THE SCATTERING COEFFICIENT WITH RELATIVE HUMIDITY
Fritz Kasten *In* WMO Radiation Including Satellite Tech. 1970 p 329–330 refs (See N71-27484 15-13)
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As the scattering coefficient of the air depends on the number and size of the aerosol particles and as increasing relative humidity allows the aerosol particles to grow by soaking, an analysis is carried out of the spectral scattering coefficient as a function of the differential growth of a single aerosol particle with relative humidity. ESRO

N71-27539 Tomsk State Univ. (USSR).
MONTE CARLO METHOD APPLIED TO SOME PROBLEMS OF NARROW LIGHT BEAMS PROPAGATION THEORY
G. M. Krekov and G. A. Mikhailov *In* WMO Radiation Including Satellite Tech. 1970 p 335–338 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

The question of the peculiarities of the application of the Monte Carlo method for one class of problems of atmospheric optics is examined. It concerns the determination of radiation field characteristics formed by the narrow collimated beams of radiation, especially those where it is impossible to neglect such factors as compound form, polydispersive structure, great optical thickness of scattering medium, non-stationarity of source, etc. A number of computer programs have been worked out and an estimation of the calculation accuracy is presented. ESRO

N71-27540 World Meteorological Organization, Geneva (Switzerland).
CORRELATIONS BETWEEN OPTICAL CHARACTERISTICS OF ATMOSPHERIC HAZE
Yu. S. Georgievsky, G. I. Gorchakov, and G. V. Rozenberg *In its* Radiation Including Satellite Tech. 1970 p 339–342 ref (See N71-27484 15-13)
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Correlation coefficients are computed between optical parameters of the air. The closest correlation is observed between the scattering coefficient and the coefficient of directed light scattering at a certain angle. Data of 150 observations have been analyzed. It is found that the family of hazes is mainly two-parametrical. ESRO

N71-27541 World Meteorological Organization, Geneva (Switzerland).
ON THE DETERMINATION OF SIZE DISTRIBUTION OF NATURAL AEROSOLS BY EXTINCTION COEFFICIENT
A. Y. Perelman *In its* Radiation Including Satellite Tech. 1970 p 349–351 refs (See N71-27484 15-13)
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A new method is proposed which is available for both transparent and absorbing particles and some other problems of atmospheric optics. ESRO

N71-27542 World Meteorological Organization, Geneva (Switzerland).
SOLUTION OF DIRECT AND SOME INVERSE PROBLEMS OF ATMOSPHERIC OPTICS WITH MONTE CARLO CALCULATIONS OF THE MAIN FUNCTIONAL
G. I. Marchuk, G. A. Mikhailov, M. A. Nazaraliev, and R. A. Darbinian *In its* Radiation Including Satellite Tech. 1970 p 355–356 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

A general purpose computer program of a compiling type has been designed in the Computer Center of the Siberian branch of the USSR Academy of Sciences for atmospheric optical problems. The program makes it possible to compute the field of light intensity, sensitivity of the intensity field towards the change of different model parameters and constants for an equivalent model with isotropic scattering. ESRO

N71-27543 Leningrad (A. A. Zhdanov) State Univ. (USSR).
ON THE SOLUTION OF SOME INVERSE PROBLEMS OF ATMOSPHERIC OPTICS
K. Y. Kondratyev, Y. M. Timofeev, O. M. Pokrovsky, A. N. Tikhonov, and V. B. Glasko *In* WMO Radiation Including Satellite Tech. 1970 p 357–362 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

Some inverse problems of atmospheric optics are reduced, under certain simplifying assumptions, to the solution of the linear integral Fredholm equation of the first kind. ESRO

N71-27560 Main Geophysical Observatory, Leningrad (USSR).
THE INFLUENCE OF RADIATION ON THE TEMPERATURE OF THE ATMOSPHERE
L. R. Rakipova *In* WMO Radiation Including Satellite Tech. 1970 p 497–502 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

An estimation of the influence of different factors determining radiation fluxes on the thermal regime of the atmosphere is given using a simplified form of the heat-flux equation. Estimations of the sensitivity of the atmospheric temperature to the variation of different radiation factors are given. The dependence of temperature on the amount of solar radiation entering the earth's atmospheric system is investigated. ESRO

N71-27561 Tel-Aviv Univ. (Israel). Inst. of Planetary and Space Science.
THE EFFECT OF TENUOUS CLOUDS ON THE FLUX OF INFRA-RED RADIATION IN THE ATMOSPHERE
Joachim H. Joseph *In* WMO Radiation Including Satellite Tech. 1970 p 503–508 refs (See N71-27484 15-13)
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Several investigators have found abnormal infrared radiative flux divergences leading to significant heating rates. A second phenomenon observed is an abnormally low value of effective black body radiation ground temperature deduced from satellite infrared measurements. An attempt is made to relate both the observed phenomenon to one and the same agent using approximate scattering laws for water and ice clouds. ESRO

N71-27562 World Meteorological Organization, Geneva (Switzerland)
RADIATIVE TRANSFER OF SOLAR RADIATION IN THE

ATMOSPHERE

O. Aveste *In its* Radiation Including Satellite Tech. 1970 p 511–516 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

A method for determining the solar radiation flux divergence as well as a method for calculating the spectral distribution of direct solar radiation and of diffuse radiation at different altitudes is developed. An approximation formula which can be used in numerical weather forecasting experiments is deduced for calculating the integral values of short-wave flux divergences. Geographical and seasonal distributions of the daily sums of solar radiation absorbed in the atmosphere were calculated. The vertical distributior of flux divergences for the clear sky as well as for the overcast sky is examined. ESRO

N71-27563 National Center for Atmospheric Research, Boulder, Colo.

RADIATIVE-CONVECTIVE EQUILIBRIUM TEMPERATURE CALCULATIONS IN THE ATMOSPHERE OF VENUS

P. Fabian, T. Sasamori, and A. Kasahara *In* WMO Radiation Including Satellite Tech. 1970 p 531–540 refs (See N71-27484 15-13)
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Quasi-equilibrium temperature distributions in the Venus atmosphere and the rates of temperature changes due to the flux divergence of solar and atmospheric radiation are discussed. Theoretical results are compared with measurements. ESRO

N71-27565 Michigan Univ., Ann Arbor. Lab. of High Altitude Engineering.

LONG-WAVE RADIATIVE TRANSFER NEAR THE MESOPAUSE

S. R. Drayson *In* WMO Radiation Including Satellite Tech. 1970 p 547–549 refs Sponsored by Natl. Sci. Found. (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

The equations governing long-wave radiative transfer in a plane parallel non-scattering planetary atmosphere require a time-consuming and complex calculation. A method is presented in which the angular integration is expressed exactly in terms of exponential integrals. Special subroutines were developed for the rapid evaluation of exponential integrals of the second, third, and fourth order. The method is applied to investigate radiative transfer near the earth mesopause. ESRO

N71-27604*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MAGNETOSPHERIC FIELD DISTORTIONS OBSERVED BY OGO'S 3 AND 5

M. Sugiura, B. G. Ledley, T. L. Skillman, and J. P. Heppner May 1971 44 p refs
(NASA-TM-X-65563; X-645-71-203) Avail: NTIS CSCL 03B

Magnetospheric field distortions are studied using approximately 10,000 data points sampled from the rubidium magnetometer measurements on OGO's 3 and 5. Analysis is made in terms of Delta B defined as the observed field magnitude minus the magnitude of a reference geomagnetic field. Average contours of equal Delta B are shown in the geomagnetic noon-midnight and dawn-dusk meridian planes for magnetically quiet and slightly disturbed conditions. These Delta B contour maps show (a) a high latitude + Delta B region on the night side and (b) an equatorial – Delta B region in the inner magnetosphere. The high latitude + Delta B region extends toward the dayside magnetosphere beyond dawn and dusk with decreasing magnitude of Delta B. Though the observations presented here do not cover southern high latitudes at appropriate geocentric distances to directly detect a southern counterpart of the + Delta B region, there is no indication in the available data to suggest absence of a similar region in the southern hemisphere. Region (b), also, the equatorial – Delta B region encircling the earth, shows greater inflation of the inner magnetosphere during magnetically quiet periods than the inflation usually assumed. Author

N71-27621# Aerojet-General Corp., El Monte, Calif. Space Div.

PASSIVE MICROWAVE MEASUREMENTS OF SNOW, SOILS, AND OCEANOGRAPHIC PHENOMENA Technical Report, 16 Nov. 1967–15 Nov. 1968

A. T. Edgerton, D. T. Trexler, G. A. Poe, A. Strogryn, S. Sekamoto et al Feb. 1970 183 p refs
(Contract Nonr-4767(00))
(AD-714855; SD-9016-6; TR-6) Avail: NTIS CSCL 14/2

Research performed during the period of this report consisted of a combination of field and laboratory investigations of the microwave emission characteristics of natural materials, and analytical modeling of the microwave radiation characteristics of selected materials to establish a better understanding of the physics of microwave emission. Author (GRA)

N71-27641*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

STRUCTURED VARIATIONS OF THE PLASMAPAUSE: EVIDENCE OF A CO-ROTATING PLASMATAIL

Harry A. Taylor, Jr., Joseph M. Grebowsky, and William J. Walsh (Aero Geo Astro Co., Beltsville, Md.) Jun. 1971 26 p refs Submitted for publication
(NASA-TM-X-65567; X-621-71-227) Avail: NTIS CSCL 03B

Direct measurements of the pole-to-pole distributions of topside thermal protons obtained with the OGO-4 ion composition experiment, near local midnight, reveal sharply structured variations of the plasmasphere boundary. With increasing L Values the proton density distribution. The time evolution of the trough boundaries observed during a sample of 5 consecutive satellite orbits following the peak of the magnetic storm on September 21, 1967 suggests that the observed structure results from a plasmatail or elongation of the plasmasphere which tends to co-rotate with the earth. The empirical model deduced indicates that, at the time of these observations, the plasmatail has a width of about 0.8L at the base, extending to an extremely thin region of 0.5L or less near the tip, and with an aximuthal extent of approximately 85 deg of longitude. The general features of the observed plasmatail structure are in accord with the time evolution of the plasmapause predicted theoretically assuming the magnitude of the thermal plasma convective flow from the magnetosphere tail varies directly with the magnetic index, Kp. Author

N71-27648*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AIR-SEA INTERACTION IN THE TROPICAL PACIFIC OCEAN

Lewis J. Allison, Joseph Steranka, Robert J. Holub (AF), John Hansen (AF), Fredica A. Godshall (NOAA) et al May 1971 108 p refs Submitted for publication
(NASA-TM-X-65558; X-651-71-191) Avail: NTIS CSCL 08C

An atlas of 3 monthly sea surface temperature anomalies in the eastern tropical Pacific Ocean was produced for the period 1949 to 1970. Sea surface temperature anomalies along the U.S. and South American west coasts and eastern tropical Pacific, appeared to be oscillating in phase from 1949 to 1970. Similarly, the satellite derived cloudiness for each of four quadrants of the Pacific Ocean, 130 E-100 W, 30 N-25 S were also pulsating in unison. The sea surface temperature anomalies were found to have a good degree of correlation both positive and negative with the monthly geophysical parameters. Several strong direct local and cross equatorial relationships were noted. In particular, the high degree of correlation between the tropical island rainfall and sea surface temperature anomalies ($r = +0.93$), permitted the derivation of sea surface temperatures in the tropics back to 1905. The

air-sea interactions indicated in this study could be potentially valuable in the prediction of the seasonal behavior of the tropical Pacific ocean and the atmosphere above it. Author

N71-27648*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTRA OF REFLECTED SOLAR ENERGY 0.4 TO 2.4 MICRONS: CLOUDS, SNOW, FIELDS
W. A. Hovis, L. R. Blaine, and M. L. Forman May 1971 123 p
(NASA-TM-X-65574; X-652-71-215) Avail: NTIS CSCL 03B

A number of spectra of reflected energy were measured utilizing a filter wedge spectrometer flown on a NASA C-47 and B-57B aircraft. These data were collected for correlation with the daylight channel of the Nimbus 3 HRIR and to estimate gain settings for the Nimbus 4 Filter Wedge Spectrometer Experiment. Each set of spectra is labeled with the Julian data of the year and a time as produced by a time code generator onboard the aircraft. Each group of spectra is preceded by a short description of the conditions and target. Altitudes given, except for radar altimeter readings, are referred to mean sea level. Author

N71-27650*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ANACOSTIA RIVER, ECOLOGICAL IMBALANCE OF AN URBAN STREAM VALLEY
Robert F. Mueller and Richard M. Lahn Dec. 1970 30 p refs
(NASA-TM-X-65549; X-644-70-446) Avail: NTIS CSCL 08H

Sources of chemical pollution, poor land use, physical pollution, and hydrologic practices are pinpointed for the eastern part of the Anacostia river basin. Suggestions are offered for further pollution documentation and remedies which may be undertaken by private and public agencies. Some consideration is also given to the ecological imbalance. Author

N71-27668*# National Aeronautics and Space Administation. Goddard Space Flight Center, Greenbelt, Md.
ESTIMATION OF TOTAL OZONE FROM SATELLITE MEASUREMENTS OF BACKSCATTERED ULTRAVIOLET EARTH RADIANCE
Carlton L. Mateer (Can. Meteorol. Serv., Toronto), Donald F. Heath, and Arlin K. Krueger Jun. 1971 23 p refs Submitted for publication
(NASA-TM-X-65576; X-651-71-223) Avail: NTIS CSCL 04A

Total ozone is estimated from Nimbus 4 satellite measurements of the attenuation of backscattered radiances at wavelengths between 3100 and 3400 A. A measurement of the backscattered radiance at 3800 A, outside the ozone absorption band, is used to determine an equivalent Lambert albedo for the cloud-ground-haze surface viewed by the instrument. The measured relative attenuation at two wavelengths is compared with such values pre-computed for a series of standard ozone profiles and corrected for the equivalent Lambert albedo. Total ozone is obtained by interpolation. Two alternative methods are used to assign an equivalent Lambert albedo at the absorbing wavelengths. In the first method, the value determined at 3800 A is assumed to be applicable at the absorbing wavelengths. In the second method, the albedo at the absorbing wavelength is calculated for a sample of 320 cases of near-coincidence with ground-based Dobson spectrophotometer measurements of total ozone. Regression equations are then developed to predict the absorbing wavelength albedo from the 3800 A albedo. Finally, these regression equations are introduced into the total ozone evaluation procedure. Total ozone values estimated by these methods are compared with the Dobson (ground-truth) data by linear regression. Author

N71-27687# Institute of Nuclear Research, Krakow (Poland).
CALIBRATION OF RADIOMETRIC PROBES FOR SOIL DENSITY MEASUREMENTS
J. A. Czubek Jul. 1970 17 p refs
(INP-715) Avail: AEC Depository Libraries

A semiempirical formula for the calibration curve of the gamma-gamma probe is presented as a function of: soil bulk density, soil chemical composition, source-detector spacing, and construction parameters of the probe. The possibility of elimination of the influence of such parameters as the chemical composition of the soil and the geometrical conditions of measurement on the probe response is discussed, using the so-called two-detector probe principle. The method of application of the semiempirical formula for density probe calibration using a small number of models is also given, using the universal calibration curve principle. Author (NSA)

N71-27671*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVED SOLAR GEOMAGNETIC CONTROL OF THE IONOSPHERE: IMPLICATIONS FOR REFERENCE IONOSPHERES
H. A. Taylor Jun. 1971 42 p refs Submitted for publication
(NASA-TM-X-65568; X-621-71-232) Avail: NTIS CSCL 03B

A study conducted with OGO-6 ion results reveals that: (1) seasonal variations in the ion distributions are generally repeatable, and (2) the annual variation in the topside O(+) and H(+) content and distribution between 1969-70 was minimal. These results would have been largely obscured in the absence of the longitudinal resolution required to provide data at appropriate solar-geomagnetic orientations. The study emphasizes the importance of magnetic field control in regulating the ion distributions, and suggests the need for the use of improved coordinate systems for the correlation of satellite observations and the development of ionospheric models. Author

N71-27700# Toulouse Univ. (France).
DIFFUSION OF THE MINOR CONSTITUENTS INTO THE TROPOSPHERE [CONTRIBUTION A L'ETUDE DE LA DIFFUSION DANS LA TROPOSPHERE DES CONSTITUANTS MINEURS]
Jean-Claude Canourdie (Ph.D. Thesis) and Jean-Claude Crestia (Ph.D. Thesis) 1970 152 p refs In FRENCH
(NP-18609) Avail: AEC Depository Libraries

In order to study the behavior of various tracers in the troposphere, diffusion models were established. The natural radioactivity (radon, thoron and their daughters) and marine aerosols were studied. After analyzing the various parameters influencing the behavior of these minor constituents, a numerical solution of the diffusion equation was presented for various source geometries in time dependent and independent conditions. These models enable the influence of various parameters on the distribution of these tracer concentrations in the troposphere to be studied. In particular, a method of determining the diffusion coefficients was developed from these models. Author (NSA)

N71-27710# Toulouse Univ. (France).
VARIOUS VERTICAL SAMPLING DEVICES FOR AEROSOLS [ETUDE DES DIFFERENTS DISPOSITIFS DE PRELEVEMENT EN ALTITUDE DES AEROSOLS]
Alain Julien (Ph.D. Thesis) 1970 86 p refs In FRENCH
(NP-18633) Avail: AEC Depository Libraries

The vertical distribution in the atmosphere of the long lived radioactive elements (Be-7, P-32, Sr-90, Pb-210, and Po-210) and the stable elements (Na, Br, Fe, P, Mn, and Cl) was studied. The connection with certain atmospheric physics problems was envisaged. The sampling devices and their setting up were studied. The interest in these particular elements and the various procedures already used, were discussed. The experimental work carried out on the filters is described. Mathematical equations for calculating

the rates of flow are solved. The experimental developments, performances obtained, and calibration procedures are presented.
Author (NSA)

N71-27731*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PLASMA WAVE DISPERSION EFFECTS OBSERVED ON THE ALOUETTE 2 nf SUB H RESONANCES
Robert F. Benson May 1971 39 p refs Submitted for publication
(NASA-TM-X-65565; X-621-71-214) Avail: NTIS CSCL 03B

Additional Alouette 2 observations, and a reevaluation of the original observations are given. The observations show that the Alouette 2 nf sub H frequency shifts are the result of a combination of a positive instrumental frequency offset, plasma wave dispersion effects, and a displacement of the ambient magnetic field from the reference field.
Author

N71-27774*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A THREE DIMENSIONAL MODEL OF THERMOSPHERIC: 1: HEAT INPUT AND EIGENFUNCTIONS
H. Volland (Bonn Univ.) and H. G. Mayr Jun. 1971 56 p refs Submitted for publication
(NASA-TM-X-65579; X-621-71-240) Avail: NTIS CSCL 04A

A three dimensional model of thermospheric dynamics is developed in terms of the eigenfunctions of the atmospheric system. Formulas for the external heat inputs like solar XUV-radiation and corpuscular heating during geomagnetic storms are derived in terms of these eigenfunctions. Those series contain tidal components (depending on local time) and planetary components (depending on seasonal time) which are the generators of tidal and planetary neutral atmospheric waves. The relative importance of corpuscular heating when compared with XUV-heating is estimated. Approximate analytic solutions for the generation and propagation of the atmospheric waves within the dissipative thermosphere, excited by the solar heat input, are given. It is shown that the eigenfunctions which are the Hough functions within the dissipative thermosphere. Moreover, the density amplitudes of the wave modes decrease proportional to 1/n(2) where n is the zonal wave domain number of the spherical harmonics. Therefore, only the wave modes with low wave domain numbers n are significant at thermospheric heights.
Author

N71-27809# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATING THE UPPER ATMOSPHERE WITH THE AID OF ARTIFICIAL ELECTRON CLOUDS
V. F. Chepura et al 30 Nov. 1970 13 p refs Transl. into ENGLISH from Tr. Inst. Prikl. Geofiz. (USSR), 15 Nov. 1969 p 214–220
(AD-720934; FTD-MT-24-266-70) Avail: NTIS CSCL 4/1

For the last decade, investigations have been conducted abroad of the physical processes in the upper layers of the atmosphere, using artificial electron clouds. Similar experiments have been initiated at the Institute of Experimental Meteorology (IEM). In accordance with programmed work, during October of 1967 artificial electron clouds were created over a point located in the central zone of the territory of the USSR. The goal of this stage of the work was to obtain experimental data for selecting the procedure of investigating physical processes in area E of the ionosphere.
Author (GRA)

N71-27948 California Univ., Berkeley.
THE REFLECTION AND REFRACTION OF MAGNETOHYDRODYNAMIC WAVES AT A LIQUID-SOLID INTERFACE, WITH APPLICATIONS TO THE EARTH'S CORE
Durward DeWitt Skiles (Ph.D. Thesis) 1969 190 p
Avail: Univ. Microfilms Order No. 70-13170

The reflection and refraction is investigated by matching the inhomogeneous electromagnetic plane wave solutions in a finitely conducting solid with the homogeneous MHD plane wave solutions in a semi-infinite fluid of infinite conductivity, zero viscosity, and zero compressibility. Both fluid and solid are permeated by a constant magnetic field of arbitrary orientation with respect to fluid-solid interface. The solution in the solid represents a single refracted wave whose amplitude decays with distance from the boundary. In thg fluid the solution consists of an incident wave, a reflected wave, and a surface disturbance which decays with distance from the boundary and which carries no energy in a direction normal to the boundary. Transmission coefficients are evaluated numerically and the theory is applied to the earth's core and lower mantle. The presence of the magnetic field renders the conducting fluid highly anisotropic and as a result the transmission of westward moving waves into the mantle is favored.
Dissert. Abstr.

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N71-26820# Air Force Cambridge Research Labs., Bedford, Mass.
AN ON BOARD INFRARED FOURIER SPECTROMETER
M. N. Markov et al 20 Nov. 1970 36 p refs Transl. into ENGLISH from the Russian Preprint 189
(AD-721184; AFCRL-70-0716; AFCRL-Trans-87) Avail: NTIS CSCL 20/6

The report describes the theory, details and performance of the laboratory prototype of a small-scale Fourier spectrometer to measure the absolute spectral intensity of the radiation from the Earth or other planets in the 10 to 40 micrometer range from aircraft, balloons, rockets or satellites.
Author (GRA)

N71-26883# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
ON-LINE COMPUTER SYSTEM FOR A MASS SPECTROMETER
L. E. Tighe Oct. 1970 23 p refs
(AAEC/TM-568) Avail: AEC Depository Libraries

Surface ionization mass spectrometers are commonly used to provide accurate isotopic abundance measurements of solid samples. The method of mass scan control is described, together with the data logging system. Also included are a description of the relevant parts in the PDP-8/L program, instructions for communication with the computer by the operator, and the computer interface circuit diagrams.
NSA

N71-26884# Panametrics, Inc., Waltham, Mass.
ULTRASONIC THERMOMETRY IN LMFBR SYSTEMS Quarterly Progress Report, Period Ending 30 Sep. 1970
E. P. Papadakis, D. R. Patch, L. C. Lynnworth, and E. H. Carnevale 30 Sep. 1970 13 p
(Contract AT(30-1)-3906)
(NYO-3906-12) Avail: NTIS

The development of the fast flux test facility simulation oven and ORTC-4 noncomposite lines is discussed, and calibration data for rhenium and tungsten/rhenium ultrasonic thermometer sensors are presented.
NSA

N71-26925*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A SIMULATION STUDY EXPLORING THE EFFECTS OF SENSOR SPATIAL RESOLUTION ON ESTIMATES OF CLOUD COVER FROM SATELLITES

William E. Shenk and Vincent V. Salomonson Washington May 1971 21 p refs

(NASA-TN-D-6247; G-1024) Avail: NTIS CSCL 14E

The effects of sensor spatial resolution on estimates of cloud cover are examined. Two dimensional simulations were made of various cloud distributions and sizes and were measured with resolution elements of various sizes. Cloud amount statistics were tabulated over a range of three orders of magnitude of the ratio R of areal cloud size to areal resolution size for six different cloud amounts and three different cloud patterns. Two estimation techniques are described and evaluated, and nomograms that substantially improve the estimates of cloud cover for known R's less than 100 are presented. The simulated cloud patterns are shown to be representative of real cloud patterns that were obtained from high resolution photographs from an Apollo flight. Author

N71-26999# Groupe de Recherches Ionospheriques, Paris (France).

STUDY AND REALIZATION OF A QUADRUPOLE PLASMA PROBE SIMULATOR FOR A SOUNDING ROCKET EXPERIMENT [ETUDE ET REALISATION D'UN SIMULATEUR DE SONDE A PLASMA QUADRIPOLAIRE EN VUE D'UNE EXPERIENCE FUSEE]

J. M. Soulat and P. Bouvet Nov. 1970 37 p In FRENCH

(GRI/NTP/78) Avail: NTIS

A simulator is described which is designed to test a quadrupole plasma probe to be flown on a sounding rocket. Besides simulating the environment, the simulator provides a means to test the electronic equipment needed to study the response of a phasemeter to phase discontinuity automatic gain control. ESRO

N71-27008* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THICKNESS MEASURING AND INJECTION DEVICE Patent

Robert L. Spencer, inventor (to NASA) Issued 9 Mar. 1971 4 p Filed 30 Jul. 1969 Cl. 1; Cl. 141-258; Cl. 222-49; Cl. 222-137; Int. Cl. B67d5/08

(NASA-Case-MFS-20261; US-Patent-3,568,885; US-Patent-Appl-SN-845990) Avail: US Patent Office CSCL 14B

A device is described for measuring the thickness of a surface material, such as spray-on foam insulation applied on a backing, and injecting a repair substance into the material. The injection gun is comprised of a needle that penetrates the thickness of the material being measured while a slidable thickness-indicating rod is pushed inwardly of the gun by an amount equal to the penetration of the needle. Two separate syringe cylinders are provided for containing fluid components that form foam insulation material when mixed and as the needle is withdrawn from the foam material the components are injected through separate needle passages into the cavity formed by the needle penetration.

Official Gazette of the U.S. Patent Office

N71-27020# Ghent Univ. (Belgium). Lab. for Strength of Materials and Welding Technology.

AN EXTENSION OF THE MOIRE METHOD FOR SURFACE DEFORMATION MEASUREMENT BY MEANS OF LASER PRODUCED GRATINGS AND WAVE-FRONT RECONSTRUCTION PROCESS

Piet Boone Brussels Centre de Rech. Sci. et Tech. de L'Ind. des Fabric. Metal. Feb. 1971 41 p refs Sponsored jointly by IRSIA and Inst. for Sci. Res. in Ind. and Agr.

(CRIF-MT-70) Copyright. Avail: NTIS

A method is described for the determination of small deformations at the surface of solid bodies. The method combines the concepts of hologram interferometry with those of using moire techniques. A theory for the interpretation of the interference fringes in terms of the deformations of the object is outlined, and some experimental applications are given. ESRO

N71-27037# General Electric Co., Syracuse, N.Y. Heavy Military Electronic Systems.

DRY FILM PROJECTOR Final Report, Apr. 1969 – Aug. 1970

J. E. Bigelow and E. F. Keppler Griffiss AFB, N.Y. RADC Feb. 1971 91 p refs

(Contract F30602-69-C-0180)

(AD-721227; RADC-TR-71-33) Avail: NTIS CSCL 14/5

The report describes development and construction of an engineering-model large-screen multicolor projector. It is designed to use a reflective photoplastic film which can be heat developed and projected immediately after recording. Recording of characters and symbols at a rate of 1000 per second by a cathode ray tube suitable for such single-frame color projection had been demonstrated in an earlier phase of development work. Limitations imposed by available optics as well as limitations to film deformation size of signals with respect to background prevented the model from meeting goals of brightness and contrast. Redirected effort has shown how a significant improvement can be made in the projector by curving the film. The result, in combination with optics designed for the application, is shown by analysis to be capable of meeting original goals, except for contrast, and of being much simpler than earlier designs. Author (GRA)

N71-27065# Oslo Univ. (Norway). Inst. of Cosmic Physics.

AURORAL PHOTOMETERS FOR THE ESRO-1/AURORAE SATELLITE

T. A. Sten Aug. 1969 34 p Sponsored by the Norweg. Space Program

Avail: NTIS

Auroral photometers were developed for the ESRO-1/AURORAE satellite launched from Vandenberg Air Force Base, California, on 3rd October 1968. The photometers are equipped with fixed interference filters centered at 4278 and 4861 A, respectively. A brief description of the photometers is given together with considerations on selection and testing of electronic components, environmental testing, and orbital performance. The photometers have been working during the winter season 1968/69 and a great amount of data has been collected. Author (ESRO)

N71-27068* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

RADIOMETRIC TEMPERATURE REFERENCE Patent

Leo G. Monford, Jr., inventor (to NASA) Issued 20 Apr. 1971 5 p Filed 26 Nov. 1969 Cl. 219-505; Int. Cl. H05b1/02

(NASA-Case-MSC-13276-1; US-Patent-3,576,585; US-Patent-Appl-SN-880272) Avail: US Patent Office CSCL 14B

A system or component with an electrical characteristic which varies with changes in its own temperature is employed as part of a feedback loop in an operational amplifier circuit. Power applied to the device raises its temperature which in turn changes the value of its electrical characteristic. The output of the operational amplifier circuit forms the input to a second operational amplifier where the polarity of the signal is inverted and fed back to the input of the first operational amplifier circuit in a positive feedback loop. The circuitry associated with the device automatically alters the power supplied to the device causing it to heat or cool until an equilibrium condition is reached, corresponding to a fixed temperature and fixed energy radiation of the device. Any tendency for variation in the temperature of the device produces an almost instantaneous change in the power supplied to the device which thus acts to maintain a constant temperature and a constant infrared energy level radiation from the body.

Official Gazette of the U.S. Patent Office

N71-27086# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
TIME COORDINATE COMPENSATOR FOR THE TIME SPECTROMETERS WITH LONG SCINTILLATORS
L. Ondrish, S. V. Mukhin, S. V. Rikhvitskii, I. N. Semenyushkin, M. Turala et al 1970 10 p refs In RUSSIAN
(JINR-P13-5378) Avail: AEC Depository Libraries

A time-coordinate compensator design for a time of flight spectrometer with long plastic scintillators is described. The compensator is triggered by pulses of standard amplitude and duration. The input pulses have the amplitude 0.3 V, the output pulse is 1 V at 50 ohm, with a duration of 15 nsec and negative polarity. The time fluctuations of the output pulse are less than + or − 50 nsec, with a change of the 50 cm long scintillator exposure place. Author (NSA)

N71-27090* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
A MULTICHANNEL PHOTOIONIZATION CHAMBER FOR ABSORPTION ANALYSIS Patent
Hongsuk H. Kim, inventor (to NASA) Issued 20 Apr. 1971 4 p Filed 1 Apr. 1969 Cl. 250-43.5R; Cl. 250-83.6R; Cl. 324-33; Int. Cl. G01t1/18
(NASA-Case-ERC-10044-1; US-Patent-3,575,597; US-Patent-Appl-SN-811892) Avail: US Patent Office CSCL 14B

A multichannel photoionization chamber is described for measuring absorption, photoionization yield, and photoionization coefficients of gases. The chamber includes a plurality of ion collection plates which permit measurement of ion current ratios to determine whether the absorption cross section is independent of both pressure and path length; i.e., Beer's law is obeyed. Pressure gauges are also described for measuring chamber pressure at locations adjacent to each of the collector plates. The pressure values corresponding to ion current maxima for each collector plate are used to determine the absorption cross section of the filling gas. Identical values of cross section calculated in this way are another indication that Beer's law is obeyed. Official Gazette of the U.S. Patent Office

N71-27111# Sandia Corp., Albuquerque, N.Mex.
OPTICAL VOLTAGE SENSORS
P. D. Thacher Jan. 1971 85 p refs Sponsored by AEC
(SC-RR-70-593) Avail: NTIS

Optical voltage sensors have been developed which indicate applied voltage by a variation in their transmission of light. These sensors can therefore be read out from a remote location using light transmitted through flexible light guides thus eliminating the normal hard wire connections. Sensors have been built which can measure voltages in the range 1-50 V to + or − 1 V with a response time of less than 1 msec. Other sensors have been designed to operate in the range 4-6 kV with an accuracy of + or − 0.1 kV for dc voltages, though less accuracy for time-varying voltages. Both sensors have capacitances in the picofarad range and dc resistances greater than 10 to the 12th power ohms. Both sensors are also only slightly larger than a TO-5 package. The choice of ceramic composition is made by means of equations relating the voltage sensitivity of the meters to electrooptic characteristics of the ceramic. These same equations are used together with information on the fixed transmittance of the sensor and the field distribution in the electrode gap to choose the proper ceramic thickness, electrode gap, and polarizer orientations. Author

N71-27188* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PEAK ACCELERATION LIMITER FOR VIBRATIONAL TESTER Patent
Carl P. Chapman, inventor (to NASA) Issued 23 Mar. 1971 6 p Filed 4 Feb. 1969 Cl. 73-71.6; Int. Cl. G01m7/00 Sponsored by NASA
(NASA-Case-NPO-10556; US-Patent-3,572,089; US-Patent-Appl-SN-796405) Avail: US Patent Office CSCL 14B

An electronic detection and protection system is provided for use with a vibrational or dynamic testing apparatus for qualification of an object such as a spacecraft component, and for preventing damage to the object during testing. The system responds to peak accelerations of either polarity above a predetermined amplitude threshold, as perceived by transducer means mounted on the object under test, to institute control effects such as deactivating the test apparatus or actuating alarm indicators, or both. The system also responds to the true root mean square current of the alternating current exciting signals flowing in the electrical drive of the test apparatus whenever a predetermined amplitude threshold is exceeded to initiate the same control effects so as to protect the electrical drive.
Official Gazette of the U.S. Patent Office

N71-27198* Aerojet-General Corp., El Monte, Calif.
ELECTRICAL APPARATUS FOR DETECTION OF THERMAL DECOMPOSITION OF INSULATION Patent
Borg Bernsen, inventor (to NASA) Issued 9 Mar. 1971 5 p Filed 5 Apr. 1968 Cl. 324-65; Cl. 60-35.6; Cl. 174-110.3; Cl. 340-227; Int. Cl. G01n27/02 Sponsored by NASA
(NASA-Case-XMF-03968; US-Patent-3,569,828; US-Patent-Appl-SN-719029) Avail: US Patent Office CSCL 14B

An article of manufacture is described that is made up of alternating layers of electrically conductive rubber and electrically nonconductive rubber with power supplied to each of the electrically conductive rubber layers and a means for measuring any change in the rate of flow of electric current between any two electrically conductive rubber layers. This article is useful as a detector for thermal decomposition of insulation. Also described is the use of the subject apparatus, especially in rocket engines.
Official Gazette of the U.S. Patent Office

N71-27215* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FRINGE COUNTER FOR INTERFEROMETERS Patent
William E. Howell and Kazmere C. Romanczyk, inventors (to NASA) Issued 30 Mar. 1971 8 p Filed 9 Oct. 1968 Cl. 356-106; Cl. 235-92; Int. Cl. G01b9/02; Int. Cl. G06f7/38
(NASA-Case-LAR-10204; US-Patent-3,572,935; US-Patent-Appl-SN-766245) Avail: US Patent Office CSCL 14B

A device for counting fringes produced by an interferometer is described. An interferometer with a single photomultiplier is used to determine the magnitude and direction of motion of an object to a digital sensitivity of one-eighth of a wavelength. By an electronic squaring technique the digital sensitivity of the device can be increased to one-sixteenth or one thirty-second of a wavelength.
Official Gazette of the U.S. Patent Office

N71-27300# Lyon Univ. (France). Inst. de Physique Nucleaire.
FABRICATION AND UTILIZATION OF LITHIUM-DRIFTED SILICON DETECTORS [FABRICATION ET UTILISATION DES DETECTEURS SILICIUM COMPENSES AU LITHIUM]
J. M. Mackowski Nov. 1969 23 p refs In FRENCH
(LYCEN-6847) Avail: AEC Depository Libraries

The discussion of lithium-drifted silicon detectors covers the principles of the method and theory of ion migration or drift, and fabrication tests and methods including lithium diffusion, measurement of the diffusion depth and the resistivity, choice of structure, test of the N/P junction, migration, and assembling. The characteristics and uses of these detectors are also considered. NSA

N71-27323* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BLACK BODY CAVITY RADIOMETER Patent
James M. Kendall, Sr., inventor (to NASA) Issued 23 Feb. 1971

8 p Filed 10 Mar. 1963 Cl. 250-83.3; Cl. 73-355; Int. Cl. G01j1/02 Sponsored by NASA
(NASA-Case-NPO-10810; US-Patent-3,566,122; US-Patent-Appl-SN-805405) Avail: US Patent Office CSCL 14B

A black body cavity radiometer is described which includes a radiation receiving isothermal body having a short hollow cylinder with a hollow cone at one end. The cylinder is spun down at the other end to a smaller hollow cylinder of short length to form a radiation cavity having an aperture. A thermal guard surrounds the cavity, except over the aperture. The annular wall of the guard around the short cylindrical extension of the cavity is provided with an internally blackened groove which functions as an annular radiation trap. Glass rods or fibers maintain a thin annular space between the guard and the cylindrical extension of the cavity. A guard temperature sensing coil is provided on a hollow cylinder. A heating and temperature sensing coil is wound directly on the main cylindrical portion of the cavity. A voltage is applied across the latter coil in sufficient amplitude to maintain the temperature of the latter coil equal to the temperature of the guard sensing coil. The magnitude of that voltage is a measure of radiation into the cavity through the aperture. Official Gazette of the U.S. Patent Office

N71-27325* Fairchild Hiller Corp., Germantown, Md.
TWO AXIS FLUXGATE MAGNETOMETER Patent
Charles J. Pellerin, Jr. and Mario H. Acuna, inventors (to NASA) Issued 23 Mar. 1971 5 p Filed 10 Dec. 1968 Cl. 324-43; Int. Cl. G01r33/02 Sponsored by NASA
(NASA-Case-GSC-10441-1; US-Patent-3,571,700; US-Patent-Appl-SN-782544) Avail: US Patent Office CSCL 14B

A two axis fluxgate magnetometer is described. A toroidal sensor that performs both a magnetic sensing function along two axes in a common plane and a magnetic multivibrator function is connected to a pair of phase sensitive detectors. A frequency doubler is connected to the multivibrator to sense the frequency of the multivibrator and to double that frequency. The output from the frequency doubler is connected to the phase detectors. The phase detectors sense an imbalance in the sense windings of the toroidal core at the second harmonic of the multivibrator frequency. The phase detectors generate dc output signals having a magnitude related to the magnitude of the magnetic field causing the imbalance and a polarity determined by the direction of the magnetic field. Official Gazette of the U.S. Patent Office

N71-27334* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
PRESSURE SENSITIVE TRANSDUCERS Patent
Wilhelm Rindner, Americo A. Iannini, and Andre Garfein, inventors (to NASA) Filed 19 Jun. 1968 Cl. 29-588; Int. Cl. B01j17/00; Int. Cl. H01l1/10
(NASA-Case-ERC-10087; US-Patent-3,566,459; US-Patent-SN-738315) Avail: US Patent Office CSCL 14B

A miniature electromechanical junction transducer is described operating on the principle of piezojunction effect. By utilizing epoxy, or other materials that are readily moldable during processing but are hard when used as the stress coupling component, and by molding the member in situ, the pressure across the surface of the mesa is uniform and the fabrication of the device is simplified. Further, the completed device is free of the damaging structural and alignment problems. Official Gazette of the U.S. Patent Office

N71-27382# Iowa State Univ. of Science and Technology, Ames.
CHEMICAL INTERFERENCES AND IONIZATION IN HIGH TEMPERATURE FLAMES
Donald Arthur Becker (Ph.D. Thesis) Feb. 1971 137 p refs
(Contract W-7405-eng-82)
(IS-T-417) Avail: NTIS

Chemical interferences or interelement effects encountered in analytical flame spectroscopy were investigated using premixed flames of acetylene and air, oxygen, or nitrous oxide. The published literature on the flame spectrometric determination of trace elements in solution widely documents the condensed-phase chemical interference effects that phosphate, sulfate, and aluminum interferents exert on the emission and absorption intensities of atomic lines of the alkaline earth metals. It is shown that the effects of these classical condensed-phase chemical interference systems can be eliminated at interferent concentrations normally encountered by employing optimal nebulization techniques and high temperature flames. However, the effects of ionization became increasingly important in high temperature flames, and ionization effects actually predominate in the description of the alkaline earth-aluminum interference systems. Author

N71-27383# Naval Observatory, Washington, D.C.
TIME SERVICE BULLETIN, SERIES 11, NO. 218
14 Dec. 1970 9 p refs
(AD-721351) Avail: NTIS CSCL 14/2

Tabular quantities presented contain portable atomic clock measurements for the time January to June, 1970. Clocks were held by primary atomic frequency standards at a slower rate than the atomic time scale and synchronized with respect to each other. Polar coordinates, seasonal and polar variation corrections were considered during compilation. G.G.

N71-27407* Radio Corp. of America, Princeton, N.J.
MAXIMUM POWER POINT TRACKER Patent
Arnold S. Cherdak and James L. Douglas, inventors (to NASA) Issued 23 Feb. 1971 10 p Filed 11 Mar. 1969 Cl. 307-126; Cl. 323-20; Int. Cl. H01h47/00 Sponsored by NASA
(NASA-Case-GSC-10376-1; US-Patent-3,566,143; US-Patent-Appl-SN-806226) Avail: US Patent Office CSCL 14B

An apparatus for detecting the instantaneous power from a power source is described that selectively disconnects the power source from a load and a battery recharging circuit upon generation of a pulse from a power peak detector or a peak absence detector. Power to the load is being supplied by the battery when the power source is disconnected. Battery overcharged protection controls further operating to override reset of the power switch and force the power source to supply a range of output voltage corresponding to the maximum power output of the source. Official Gazette of the U.S. Patent Office

N71-27448# Human Factors Research, Inc., Goleta, Calif.
ELASTIC SURFACE TRANSFORMATION Final Report, 19 Jan. 1967 - 14 Jan. 1971
Robert J. Hall, Gene R. Kelley, and Albert Harabedian Mar. 1971 35 p refs
(Contract N00014-67-C-0312)
(AD-720345; TR-775-F) Avail: NTIS CSCL 14/5

The report contains a summary of the first three years of work and a detailed description of the last year of work on the Elastic Surface Transformation--a new signal enhancement technique. An elastic film was developed and used to test the concept of the Elastic Surface Transformation. The results showed that the concept is valid: images acquired on an expanded elastic film were enhanced when the film was contracted; i.e., edge spread (blur) was reduced, contrast was increased, and the ability of observers to detect low contrast images was increased. Implementation of the concept by means of an elastic film would require an improvement in the quality of the elastic emulsion. But the concept may be implemented electronically. An electronic implementation is within the state-of-the-art. Author (GRA)

N71-27480# Sandia Corp., Albuquerque, N.Mex.
CAPABILITY AND LIMITATION STUDY OF THERMOGRAPHY OF CARBON-CARBON CONES
B. Stiefeld and R. H. Yoshimura Jan. 1971 37 p refs
Sponsored by AEC

(SC-DR-70-884) Avail: NTIS

A series of nondestructive tests utilizing a new thermal detector, known as a thermal transducer, and an infrared scanning camera has been conducted on a series of carbon-carbon test cones. The results of these tests as compared to other NDT procedures are discussed. Recommendations regarding the capability of the thermal transducer are made, and some unique methods of displaying data acquired by the infrared scanner are shown. Author

N71-27481# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.

COMPUTER CONTROLLED GAS CHROMATOGRAPH CAPABLE OF REAL-TIME READOUT OF HIGH PRECISION DATA

R. S. Swingle and L. B. Rogers 1970 33 p refs

(Contract AT(11-1)-1222)

(COO-1224-44) Avail: NTIS

A gas chromatograph has been assembled which provides computer control of sample injection, column temperature, and flow rate, plus direct computer readout of inlet pressure, mass flow rate, and detector response. Data processing yields, in real time, a standard deviation of less than 0.05% in retention time, which is comparable to previous results obtained using an off-line computer. However, corrected retention volumes determined in real time had a standard deviation of about 0.4% which reflected primarily the uncertainty in flow measurement. Author

N71-27488 Reading Univ. (England).

THE SELECTIVE CHOPPER RADIOMETER FOR ATMOSPHERIC TEMPERATURE SOUNDING FROM NIMBUS D

J. T. Houghton, G. E. Peckham, and S. D. Smith *In* WMO Radiation Including Satellite Tech. 1970 p 5–8 refs Prepared jointly with Oxford Univ. (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

A radiometer based on multilayer interference filters, used to measure emission from carbon dioxide and hence to deduce the temperature structure of the atmosphere, is described. Successful tests have been made and the radiometer is due to be launched in the Nimbus D satellite. ESRO

N71-27490 World Meteorological Organization, Geneva (Switzerland).

INSTRUMENTATION OF THE SATELLITE COSMOS-149 FOR MEASUREMENTS OF RADIATION CHARACTERISTICS OF THE EARTH

A. K. Gorodetsky, M. S. Malkevich, G. V. Rozenberg, V. I. Syachinov, and G. P. Faraponova *In its* Radiation Including Satellite Tech. 1970 p 25–36 refs (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

The main characteristics of Cosmos 149 instruments used for measurement of solar and infrared radiation emerging from the earth are discussed. The photometers, IR radiometers, and instruments for radiation balance measurements are described. Results are shown in the form of curves. ESRO

N71-27544 Finnish Meteorological Office, Helsinki.

A NEW DISTILLATION INSTRUMENT AS EFFECTIVE PYRANOMETER

Veikko Rossi *In* WMO Radiation Including Satellite Tech. 1970 p 369–373 ref (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

A distillation instrument similar to the Bellani pyranometer is described which measures the short and long wave components of the radiation balance incident on and reflected from a black surface directed upwards and downwards. ESRO

N71-27545 Institut Royal Meteorologique de Belgique, Brussels.

RECENT DEVELOPMENTS IN ABSOLUTE RADIOMETRY IN THE RADIATION LABORATORY OF THE ROYAL BELGIAN METEOROLOGICAL INSTITUTE

D. Crommelynck and R. Dogniaux *In* WMO Radiation Including Satellite Tech. 1970 p 375–381 (See N71-27484 15-13)

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An absolute radiometer has been designed at the Royal Meteorological Institute of Belgium the detector of which is a heat fluxmeter containing many thermocouples connected in series in order to reduce the thermal resistance. The accuracy of the instrument is discussed. ESRO

N71-27546 Eppley Lab., Inc., Newport, R. I.

A NEW APPROACH TO THE MEASUREMENT OF TERRESTRIAL LONG-WAVE RADIATION

A. J. Drummond, W. J. Scholes, J. H. Brown (Naval Undersea Warfare Center, San Diego, Calif.), and R. E. Nelson *In* WMO Radiation Including Satellite Tech. 1970 p 383–387 (See N71-27484 15-13)

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The development of an infrared radiometer with a great accuracy is described. Other features such as stability of performance, high sensitivity, and a response time of about 3 seconds are discussed. ESRO

N71-27547 Ludwig-Maximilians-Universitat, Munich (West Germany). Meteorologisches Inst.

A SPECTRO-RADIOMETER FOR INFRA-RED CLOUD TRANSMISSION MEASUREMENTS

H.-J. Bolle, H. Grassl, and P. Wendling *In* WMO Radiation Including Satellite Tech. 1970 p 389–392 (See N71-27484 15-13)

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A portable spectro-radiometer for simultaneous cloud transmission measurements has been designed. It consists of a two-channel spectrometer part and an eight-channel radiometer equipped with interference filters. The spectrometer can be set to all wavelengths between 7 and 30 microns. Results of measurements are discussed. ESRO

N71-27548 Meteorological Research Inst., Tokyo (Japan).

THE INFLUENCE OF CIRCUMSOLAR RADIATION ON MEASUREMENTS OF DIRECT SOLAR RADIATION

K. Sekihara, M. Kano, K. Murai, F. Fujimoto, and T. Suzuki *In* WMO Radiation Including Satellite Tech. 1970 p 393–397 refs (See N71-27484 15-13)

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Measurements of direct solar radiation and of circumsolar radiation have been carried out simultaneously during fine weather conditions. Direct solar radiation was measured by both an Angstrom compensation pyrheliometer and a silver disk pyrheliometer. Intensity of circumsolar radiation was measured by an aureole spectrophotometer. The influence of the aperture angle in pyrheliometers is discussed. ESRO

N71-27550 World Meteorological Organization, Geneva (Switzerland).

COMPLEX INSTRUMENTATION FOR OPTICAL INVESTIGATION OF THE ATMOSPHERE

Y. S. Georgievsky, G. I. Gorchakov, V. I. Dianov-Klokov, L. G. Elagina, Y. S. Lybovtseva et al *In its* Radiation Including Satellite Tech. 1970 p 407–410 ref (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

A versatile observation equipment developed for optical observation of the atmosphere is described. Reliability and reproductibility of measurement are discussed. ESRO

N71-27551 Lille Univ. (France). Dept. of Physics.
DESIGN OF AN INFRARED RADIOMETER FOR MEASURING SEA-SURFACE TEMPERATURE
Pierre Yves Deschamps and Pierre Lecomte *In* WMO Radiation Including Satellite Tech. 1970 p 413-415 refs (See N71-27484 15-18
Copyright. Avail: Issuing Activity

The design of an infrared radiometer suitable for ocean-surface temperature measurements with an accuracy of about 0.3 C is described. This instrument relies on comparison of the energy coming from the surface of the water and that of a temperature controlled black body cavity. ESRO

N71-27552 Southwest Center for Advanced Studies, Dallas, Tex.
MEASUREMENTS IN THE 13-15 MICRONS RANGE WITH A GRILLE SPECTROMETER
Brian A. Tinsley *In* WMO Radiation Including Satellite Tech. 1970 p 421-422 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

A description is given of a grille spectrometer used for inflight measurements of infrared spectra, water vapor, ozone, and carbon dioxide. The advantages and disadvantages of the equipment are considered. ESRO

N71-27553 Eppley Lab., Inc., Newport, R. I.
SOURCES FOR CALIBRATING LONG-WAVE RADIATION DETECTORS
A. R. Karoli and J. R. Hickey *In* WMO Radiation Including Satellite Tech. 1970 p 423-429 (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

The design of radiating surfaces to provide compact infrared sources for use in calibrating a satellite infrared spectrometer with a 12 x 12 degree field of view is discussed. An array of small cavities was selected for the emitting surface. Two methods of control are employed to achieve the desired operational temperature range. One utilizes thermoelectric heat pumping over a range of -40 to +60 C, the other combines liquid nitrogen and resistive heating to provide a secondary standard operating between -195 and +100 C. ESRO

N71-27554 Army Electronics Command, Ford Monmouth, N. J. Atmospheric Sciences Lab.
IMPROVEMENT OF THE TIME RESPONSE OF A THERMAL RADIOMETER BY MEANS OF AN ANALOGUE TECHNIQUE
Reinhold M. Marchgraber *In* WMO Radiation Including Satellite Tech. 1970 p 431-435 (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

The response of the thermal radiometer to temporal changes of radiant fluxes depends upon the thermal time constants involved. The time for a 99% response to a sudden change in radiant flux lies, for most available instruments, in the range from a few seconds to a minute, and is sufficient for most measurements. However, in special cases the response of available instruments may not suffice and the accuracy of the measurement deteriorates with increasing absolute values of the first derivative of the input. Thus, time varying fluxes do not lend themselves directly to error-free measurement nor do they allow error-free integration over discrete intervals of time. An analog technique is described which avoids all domain transformations and can be performed simultaneously with the measurement in real time. Further, it is not limited to linear measuring systems. ESRO

N71-27555 World Meteorological Organization, Geneva (Switzerland).
A LABORATORY SYSTEM FOR SHORT-WAVE CALIBRATION OF RADIOMETERS
B. G. Collins *In its* Radiation Including Satellite Tech. 1970 p 459-466 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

A system is described which enables short-wave calibration of radiometers independent of weather conditions. It uses a high pressure 2 kw xenon arc as source intensity and spectral distribution of the radiation is comparable with those of solar radiation. The calibration procedure is described and results discussed. ESRO

N71-27556 Naval Undersea Warfare Center, San Diego, Calif. Arctic Sciences Div.
THE ABSOLUTE CALIBRATION OF A LONG-WAVE RADIOMETER
James H. Brown *In* WMO Radiation Including Satellite Tech. 1970 p 467-471 ref (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

A new long-wave hemispherical radiometer, which measures radiant energy in the 3.50 micron spectrum is described. An absolute method of calibrating this radiometer is discussed. ESRO

N71-27606*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A NEAR INFRA-RED RADIOMETER FOR USE ON SMALL SOUNDING ROCKETS
Jean Welker and W. H. Jones Nov. 1969 24 p refs
(NASA-TM-X-65548; X-615-69-500) Avail: NTIS CSCL 14B

An infrared radiometer was designed, developed, and calibrated to detect the radiation emission from the molecular transition of O2 during the daytime in the D region. The emission transition is a band over 200 A wide which is centered at 1.268 microns. The radiometer is mounted on a sounding rocket. The advantages and disadvantages of such a mounting configuration are discussed. E.H.W.

N71-27611# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUNDAMENTAL PARAMETERS OF IMAGE TEST FILMS
Ye. L. Nelskiy et al 25 Jan. 1971 15 p refs Transl. into ENGLISH from Tekhnika Kino i Televideniya (Moscow), v. 14, no. 6, 1970 p 28-31
(AD-720951; FTD-MT-24-295-70) Avail: NTIS CSCL 14/5

An attempt was undertaken to clarify information about contemporary image test films, and to establish, mainly in mass produced film samples, the level of their quality in terms of fundamental technical parameters. During the work, by means of laboratory methods, more than 30 film samples of different countries were studied. Besides film samples, data of catalogs, standard documents, etc., were incorporated. Author (GRA)

N71-27622# Aeronautical Research Labs., Melbourne (Australia).
A DIGITAL TIME CODE GENERATOR FOR AIRBORNE APPLICATIONS
M. D. Card Sep. 1970 16 p refs
(ARL/F-45) Avail: NTIS

A digital time code generator suitable for airborne use has been developed. The generator includes a solid state visual display of time, and a different means of synchronization with another time code generator. Author

N71-27711*# TRW Systems Group, Redondo Beach, Calif. Communication and Sensor Systems Dept.
TECHNIQUE FOR MEASURING TIME-BASE ERRORS OF MAGNETIC INSTRUMENTATION RECORDERS/REPRODUCERS
R. J. Chan 17 May 1971 27 p refs
(Contract NAS9-8166)
(NASA-CR-115029; TRW-17618-H156-R0-00) Avail: NTIS CSCL

148

A general measurement technique is described for determining the time-base errors associated with recorded and played back digital data. The technique requires the measurement of tape flutter spectral density, amplitude cumulative probability distribution, root-mean-squared time-plot, FM discriminator sensitivity, and peak-to-peak percent flutter. Two analytical expressions are presented to calculate the time-base error or "jitter". One expression determines the time-base error when the tape flutter is known to have Gaussian amplitude statistics and a uniform spectral density. The other expression may be used when the flutter is periodic. An important flutter measurement that is not usually made is the amplitude cumulative probability distribution. This measurement is significant because it makes it possible to assign a statistical confidence to the percent time-base error, thus establishing bounds time-base errors which manufacturers may specify for their recorders/reproducers. Author

N71-27791# Institute of Nuclear Physics, Krakow (Poland).
VINCA NOVA: AN AUTOMATIC UNIT FOR NEUTRON SPECTROMETER CONTROL
J. Brankowski, W. Olejarczyk, T. Sarga, J. Sciesinski, and T. Zaleski Jun. 1970 21 p refs
(INP-707) Avail: AEC Depository Libraries

A boron trifluoride proportional neutron spectrometer control unit is described. Its operational program can be accomplished manually or automatically by means of punched tape. The unit is constructed with solid-state elements. The logical structure and co-ordination of blocks are described. To illustrate the electronic details one block is described. The technical parameters of the Vinca Nova unit are given. Author

N71-27793# CORDIN, Salt Lake City, Utah.
TRANSIT-TIME ACCELERATORS Final Report, 13 Mar.–24 Dec. 1970
Sidney J. Nebeker and Marvin R. Yancey 24 Dec. 1970 44 p
(Contract F19628-70-C-0240)
(AD-720880; AFCRL-71-0026) Avail: NTIS CSCL 14/2

The report contains a summary of the objectives and specifications. The fabrication and testing of the transit time accelerometers is also discussed. Diagrams of the test set-up are also included. The appendix includes actual test data for each of the accelerometers in tabulated form. The drawings which have been updated or added since the previous accelerometer order are also included. Author (GRA)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N71-26826*# National Aeronautics and Space Administration, Washington, D.C.
INTERDISCIPLINARY APPROACH TO THE LUBRICATION OF CONCENTRATED CONTACTS
P. M. Ku (Southwest Res. Inst.), ed. 1970 595 p refs Proc. of a Symp. held at Troy, N.Y., 15–17 Jul. 1969
(NASA-SP-237) Avail: SOD $2.50; NTIS HC $8.00/MF $0.95 CSCL 11H

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2. ELASTOHYDRODYNAMIC LUBRICATION D. Dowson (Leeds Univ., England) p 27–76 (See N71-26828 15-15)

3. MICROSLIP AND CREEP IN CONTACTS H. Poritsky (Poritsky (H), Schenectady, N.Y.) p 77–152 refs (See N71-26829 15-23)

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6. THE RHEOLOGICAL BEHAVIOR OF LUBRICANTS H. Naylor (Shell Research, Ltd., Chester (England)) p 279–307 refs (See N71-26832 15-15)

7. THE MECHANISM OF CONTACT FATIGUE W. E. Littmann (Timken Roller Bearing Co., Canton, Ohio) p 309–377 refs (See N71-26833 15-15)

8. EFFECT OF MATERIALS: GENERAL BACKGROUND E. V. Zaretsky and W. J. Anderson (NASA, Lewis Res. Center, Cleveland, Ohio) p 379–408 refs (See N71-26834 15-15)

9. EFFECTS OF MATERIALS: METALLURGY VIEWPOINT E. N. Bamberger (GE, Cincinnati, Ohio) p 409–437 refs (See N71-26835 15-15)

10. EFFECTS OF LUBRICANTS: GENERAL BACKGROUND J. K. Appeldoorn (Esso Research and Engineering Co., Linden, N.J.) p 439–462 refs (See N71-26836 15-15)

11. ADSORPTION AND SURFACE ENERGETICS A. J. Haltner (GE, Philadelphia, Pa.) p 463–488 refs (See N71-26837 15-15)

12. CHEMISTRY IN CONCENTRATED CONJUNCTION LUBRICATION R. S. Fein (Texaco Research Center, Beacon, N.Y.) p 489–527 refs (See N71-26838 15-15)

13. BEARING DESIGN CONSIDERATIONS F. W. Wellons and T. A. Harris (SKE Industries, Inc., King of Prussia, Pa.) p 529–549 refs (See N71-26839 15-15)

14. GEAR DESIGN CONSIDERATIONS W. Coleman (Gleason Works, Rochester, N.Y.) p 551–589 refs (See N71-26840 15-15)

N71-26827*# Caterpillar Tractor Co., Peoria, Ill.
LUBRICATION OF CONCENTRATED CONTACTS: THE PRACTICAL PROBLEM
B. W. Kelley *In* NASA, Washington Interdisciplinary Approach to the Lubrication of Concentrated Contacts 1970 p 1–26 refs (See N71-26826 15-15)
Avail: SOD $2.50; NTIS HC $8.00/MF $0.95 CSCL 11H

The manufacturer of machines that depend on the reliable performance of heavily loaded concentrated contacts such as those occurring on gears, bearings, and cams is faced with the development of practical design criteria for predicting the onset of the many potential modes of failure. Almost all of these modes are significantly affected by the material and the lubricant rheology and chemistry. Summarizes are the efforts of the manufacturer and designer in extracting useful information from this multidisciplinary field and attempts to focus attention on those complex problems that have not yet yielded, in any quantitative sense, to research. Author

N71-26828*# Leeds Univ. (England).
ELASTOHYDRODYNAMIC LUBRICATION
D. Dowson *In* NASA, Washington Interdisciplinary Approach to the Lubrication of Concentrated Contacts 1970 p 27–76 refs (See N71-26826 15-15)
Avail: SOD $2.50; NTIS HC $6.00/MF $0.95 CSCL 11H

Significant theoretical and experimental developments of elastohydrodynamics in lubrication regimes are discussed and the essential features of elastohydrodynamic contacts are described. Attention is focused upon film thickness calculations and measurements since these represent the most important and best

charted fields within the subject, but friction and the distribution of pressure are also considered. Transition from hydrodynamic to elastohydrodynamic and boundary lubrication conditions is considered, and attention is drawn to the importance of the ratio of film thickness/surface roughness. A number of successful engineering applications of elastohydrodynamics are noted, and the present trends in research are outlined. Author

N71-26830*# Technische Hogeschool, Delft (Netherlands).
THE POSTULATE ABOUT THE CONSTANCY OF SCORING TEMPERATURE
Harmen Blok *In* NASA, Washington Interdisciplinary Approach to the Lubrication of Concentrated Contacts 1970 p 153–248 refs (See N71-26826 15-15)
Avail: SOD $2.50; NTIS HC $6.00/MF $0.95 CSCL 11H

The scoring performance of nonadditive mineral oils in gears and simulating testers is analyzed in order to evaluate the postulate about the constancy of scoring temperatures and the upper and lower bounds of the applicable scoring temperature range. The corresponding generalization for the flash temperature theory is given and refinements related to the prediction of bulk temperature are described and used to estimate the maximum temperature in the conjunction zone of two rubbing surfaces for which the scoring risks are assessed. A thermal network theory for gear transmission is outlined. No single scoring mechanism or combination of such mechanisms is found to explain the applicability of the postulate. G.G.

N71-26831*# Utah Univ., Salt Lake City.
THE STRUCTURE OF LIQUIDS
H. Eyring and M. S. Jhon (Va. Univ.) *In* NASA, Washington Interdisciplinary Approach to the Lubrication of Concentrated Contacts 1970 p 249–278 refs (See N71-26826 15-15)
Avail: SOD $2.50; NTIS HC $6.00/MF $0.95 CSCL 20D

Early models of the liquid state are briefly reviewed, and the present status of the significant structure theory is presented. For simple substances such as argon, this theory provides a model without adjustable parameters. For more complicated molecules such as lubricants, a knowledge of certain properties leads to a prediction of the remaining properties. The calculation of such properties is discussed in conjunction with the research needed to understand lubricants. The properties discussed are: (1) thermodynamic properties; (2) ordinary and bulk viscosity; (3) thermal conductivity; (4) sound velocity; and (5) surface tension. Author

N71-26832*# Shell Research, Ltd., Chester (England). Thornton Research Center.
THE RHEOLOGICAL BEHAVIOR OF LUBRICANTS
H. Naylor *In* NASA, Washington Interdisciplinary Approach to the Lubrication of Concentrated Contacts 1970 p 279–307 refs (See N71-26826 15-15)
Avail: SOD $2.50; NTIS HC $6.00/MF $0.95 CSCL 11H

A number of rheological models are discussed that have been applied in attempts to explain phenomena involving lubricant film thickness and frictional tractions, and to examine the extent to which each has been successful. It is concluded that existing knowledge of the rheological properties of lubricants is, in every case, insufficient to allow critical evaluation. Author

N71-26833*# Timken Roller Bearing Co., Canton, Ohio.
THE MECHANISM OF CONTACT FATIGUE
W. E. Littmann *In* NASA, Washington Interdisciplinary Approach to the Lubrication of Concentrated Contacts 1970 p 309–377 refs (See N71-26826 15-15)
Avail: SOD $2.50; NTIS HC $6.00/MF $0.95 CSCL 13I

Lubricant viscosity and composition both affect the origin and propagation of contact fatigue cracks, whether from surface or subsurface origins. It is useful to classify contact fatigue damage according to a system that is related to the origin, propagation mode, and macroscopic appearance of advanced stages of damage. Material and environmental factors, especially temperature and lubrication, coupled with load, contact geometry, surface microtopography, and EHD film thickness are the primary variables that combine to control the predominant mode of contact fatigue damage and the useful life that can be obtained in a given situation. Author

N71-26834*# National Aeronautic and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF MATERIALS: GENERAL BACKGROUND
E. V. Zaretsky and W. J. Anderson *In its* Interdisciplinary Approach to the Lubrication of Concentrated Contacts 1970 p 379–408 refs (See N71-26826 15-15)
Avail: SOD $2.50; NTIS HC $6.00/MF $0.95 CSCL 13I

A review of state-of-the-art and current advances in rolling element bearing material technology is presented. Topics include materials, inclusion content, heat treatment, fiber orientation, residual stresses, ausforming, component differential hardness, and material dislocations. Author

N71-26835*# General Electric Co., Cincinnati, Ohio.
EFFECTS OF MATERIALS: METALLURGY VIEWPOINT
E. N. Bamberger *In* NASA, Washington Interdisciplinary Approach to the Lubrication of Concentrated Contacts 1970 p 409–437 refs (See N71-26826 15-15)
Avail: SOD $2.50; NTIS HC $6.00/MF $0.95 CSCL 13I

The state-of-the-art of metallic materials technology as related to rolling-element bearings is reviewed with emphasis on those bearing structural materials which can operate within the capabilities of today's fluid lubricants. The contributions of alloy development, alloy modifications, melting techniques, metalworking processes, and powder metallurgy procedures to improved bearing materials performance are discussed. It is shown that while satisfactory progress has been made in some of these technologies, other areas have lagged. This is due to the use of improper criteria for predicting the behavior of a material under rolling contact conditions. Author

N71-26836*# Esso Research and Engineering Co., Linden, N.J.
EFFECTS OF LUBRICANTS: GENERAL BACKGROUND
J. K. Appeldoorn *In* NASA, Washington Interdisciplinary Approach to the Lubrication of Concentrated Contacts 1970 p 439–462 refs (See N71-26826 15-15)
Avail: SOD $2.50; NTIS HC $6.00/MF $0.95 CSCL 11H

In concentrated contact, the quality of the oil is frequently dictated by requirements other than friction and wear. In particular, the oil must have good stability: thermal, oxidative, and hydrolytic. For the lubrication process itself, viscosity is the only physical property of importance, but chemical properties are even more important. The selection of these depends on whether the limiting failure mode is scuffing, gradual wear, or fatigue pitting. Author

N71-26837*# General Electric Co., Philadelphia, Pa.
ADSORPTION AND SURFACE ENERGETICS
A. J. Haltner *In* NASA, Washington Interdisciplinary Approach to the Lubrication of Concentrated Contacts 1970 p 463–488 refs (See N71-26826 15-15)
Avail: SOD $2.50; NTIS HC $6.00/MF $0.95 CSCL 11H

The surface properties of solids are critical factors affecting the course of friction and wear in concentrated contacts. The physical and chemical states of the surface affect such processes as surface deformation and interaction with the environment. Surface energy remains a useful parameter for interpreting and predicting interactions that occur at interfaces such as wetting and spreading. Surface energies for solids range from around 20 ergs/sq cm (low energy surfaces) to more than 2000 ergs/sq cm

(high energy metal surfaces). The range of surface forces depends on the various types of force fields that may be involved. The application of equilibrium thermodynamic analysis to surface involved in sliding has considerable validity. However, limitations on such analyses may be imposed by kinetic restrictions inherent in the thermodynamically allowed processes that may be occurring in the interface region. Author

N71-26838*# Texaco Research Center, Beacon, N.Y.
CHEMISTRY IN CONCENTRATED CONJUNCTION LUBRICATION
R. S. Fein *In* NASA, Washington Interdisciplinary Approach to the Lubrication of Concentrated Contacts 1970 p 489–527 refs (See N71-26826 15-15)
Avail: SOD $2.50; NTIS HC $6.00/MF $0.95 CSCL 11H

Consideration of the physical mechanisms involved in lubrication, wear, and surface damage indicates the probably important physical properties of wear surface reaction products. These properties particularly include flow and elastic characteristics, thermal conduction characteristics, and ability to non-thermally affect substrate metal deformation. An understanding of chemical effects on wear and surface damage requires development of knowledge about the pertinent physical properties of wear surface reaction-product films. These properties need to be correlated with system chemistry and operating conditions and with film performance in terms of wear and surface damage. Achievement of these correlations requires techniques for micro-scale, in situ measurement of wear surface film rheological and thermal conduction properties. Author

N71-26839*# SKF Industries, Inc., King of Prussia, Pa.
BEARING DESIGN CONSIDERATIONS
F. W. Wellons and T. A. Harris *In* NASA, Washington Interdisciplinary Approach to the Lubrication of Concentrated Contacts 1970 p 529–549 refs (See N71-26826 15-15)
Avail: SOD $2.50; NTIS HC $6.00/MF $0.95 CSCL 13I

The importance of elastohydrodynamic lubrication on rolling element bearing performance and design is discussed. Special emphasis is given to the problems of fatigue and skidding in rolling element bearings, showing how the knowledge of elastohydrodynamics can be applied to facilitate understanding of these problems and to provide rational design guidance. Author

N71-26840*# Gleason Works, Rochester, N.Y.
GEAR DESIGN CONSIDERATIONS
W. Coleman *In* NASA, Washington Interdisciplinary Approach to the Lubrication of Concentrated Contacts 1970 p 551–589 refs (See N71-26826 15-15)
Avail: SOD $2.50; NTIS HC $6.00/MF $0.95 CSCL 13I

The parameters of gears and gear lubrication that affect wear, pitting, and scoring are discussed. Formulas for sliding and rolling velocities and for relative radii of profile and lengthwise curvatures between gear teeth are listed. The effects of load sharing between teeth are considered, and formulas for contact stress are developed. The duration of tooth contact and the variation in coefficient of friction are considered. The aspects of oil film thickness and critical temperature are presented in relation to gear tooth wear and scoring. A discussion of gear testing and simulated gear testing by means of rollers emphasizes the advantages of each. Author

N71-26910*# Aerojet-General Corp., Azusa, Calif.
BALL BEARING DESIGN FOR THE SNAP-8 TURBOALTERNATOR AND MERCURY PUMP
R. S. Foley May 1971 81 p refs
(Contract NAS5-417)
(NASA-CR-72825; AEROJET-3656) Avail: NTIS CSCL 13I

The design and application of angular-contact, tool-steel ball bearings used in the turbine-alternator and the mercury pump of the SNAP-8 electrical generating system are reported. These SNAP-8 rotating machines run on ball bearings with a design objective of 99.5% reliability for 10,000 hours of continuous operation. A summary of ball bearing operating experience through September 1970 is presented. The bearing design selected for operation in the SNAP-8 system has exceeded the original life objectives, and has operated in excess of 23,000 hours. From the experience gained to date, it is anticipated that bearing life of five years or greater is feasible. Author

N71-27006* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DYNAMIC VIBRATION ABSORBER Patent
William B. Igoe, inventor (to NASA) Issued 23 Mar. 1971 5 p Filed 30 Jun. 1969 Cl. 73-147; Int. Cl. G01m9/00
(NASA-Case-LAR-10083-1; US-Patent-3,572,112; US-Patent-Appl-SN-837825) Avail: US Patent Office CSCL 13I

A tuned damped vibration absorber is described for a mass vibrating in more than one degree freedom of motion. It consists of a cantilever spring and attached mass designed so that they absorb vibrations simultaneously at different frequencies in corresponding different degrees of motion.
Official Gazette of the U.S. Patent Office

N71-27044# Forgeal, Issoire (France).
NEW BASIS OF CLASSIFICATION AND SELECTION OF ALUMINUM ALLOYS [NOUVEAUX CRITERES DE CARACTERISATION ET DE SELECTION DES ALLIAGES D'ALUMINUM]
J. Tigeot *In* AGARD The Characterization and Appl. of Mater. May 1971 28 p refs In FRENCH and ENGLISH (See N71-27038 15-18)
Avail: NTIS

Aluminium alloys are the material most widely used in modern airframe construction since, even where they are designed to fly at around Mach 2.5, military aircraft do not hold these speeds long enough for the temperature increase due to airflow to affect the performance of the light alloys involved. The aluminium alloys most frequently used are: aluminium/copper/magnesium alloys, or aluminium/zinc/magnesium/copper alloys. Reviewed are attempts to: improve the normal mechanical properties of alloys, refine assessment of the susceptibility of an alloy to brittle fracture, obtain greater understanding of corrosion performance, and determine fatigue performance. Author

N71-27067* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
EMERGENCY ESCAPE SYSTEM Patent
John T. McGough, Robert A. McDaris, Charles R. Billings, Paul F. Neal, and James C. Sweat, inventors (to NASA) Issued 9 Mar. 1971 8 p Filed 2 Oct. 1971 Cl. 182-10; Cl. 188-65.5; Int. Cl. B61b7/20
(NASA-Case-XKS-07814; US-Patent-3,568,795; US-Patent-Appl-SN-672384) Avail: US Patent Office CSCL 13I

An automatic braking device for preattachment to a cable connected between high and low elevational points to provide an emergency escape system is described. The braking device and cable are so arranged that as a person using the emergency escape system descends from the high elevational point, the slope of the cable causes the angle of the braking device to change in relation to the cable thereby effectuating gradual stopping of the person as he approaches the lower elevational point.
Official Gazette of the U.S. Patent Office

N71-27068* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRESSURE SEAL Patent
Ewald Heer, Calvin M. Beylik, John A. Garba, and Frank W. Orlik,

inventors (to NASA) Issued 9 Mar. 1971 5 p Filed 14 Apr. 1969 Cl. 220-46; Int. Cl. B65D53/02 Sponsored by NASA
(NASA-Case-NPO-10796; US-Patent-3,568,874;
US-Patent-Appl-SN-815760) Avail: US Patent Office CSCL 11A

A pressure seal is described for establishing hermetic seals and for use in coupling test specimens to test fixtures within environmental chambers of the type employed in simulating changing theoretical or known conditions of temperature and pressure which are encountered as a spacecraft approaches a given celestial body enveloped in an atmosphere. The pressure seal encompasses a rigid annular seat mounted on the test specimen and an annular flexible skirtlike sealing member mounted on the test fixture and extended to circumscribe and engage the rigid seat, while being adapted to open and close in response to preselected pressure differentials established across the seal. D.L.G.

N71-27084* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MULTIDUCTED ELECTROMAGNETIC PUMP Patent
Jerry P. Davis and Gerald M. Kikin, inventors (to NASA) Issued 2 Mar. 1971 6 p Filed 16 Apr. 1969 Cl. 417-50; Int. Cl. F04b19/00 Sponsored by NASA
(NASA-Case-NPO-10755; US-Patent-3,567,339;
US-Patent-Appl-SN-816733) Avail: US Patent Office CSCL 13K

An apparatus for pumping conductive liquids is described which comprises a single toroidal electromagnetic pump structure having a number of passages with each containing a two pump duct sandwich. Each pump duct has a plural tube header connected to its input and output portions, and each tube of the header assemblies is electrically insulated from adjacent tubes to minimize the bypass current flow. Current flow through the pump ducts is in a counter flow arrangement in order to minimize field distortion. The single toroidal pump structure may therefore comprise any conventional number of individual pumps formed within the compact configuration. Official Gazette of the U.S. Patent Office

N71-27091* General Motors Corp., Santa Barbara, Calif. Defense Research Labs.
RESILIENT WHEEL Patent
John N. Calandro, Norman J. James, and Ferenc Pavlics, inventors (to NASA) Issued 9 Mar. 1971 6 p Filed 17 Feb. 1969 Cl. 152-250; Cl. 152-225; Int. Cl. B60c7/06 Sponsored by NASA
(NASA-Case-MFS-13929; US-Patent-3,568,748;
US-Patent-Appl-SN-779847) Avail: US Patent Office CSCL 13I

A resilient wheel is described which is comprised of a woven wire tire clamped to the rim of a conical wheel disc. The tread surface of the wire tire has tread units composed of abrasive coated strips clamped to the wire tire and arranged in a herringbone pattern around the tread area of the tire. A relatively rigid annular frame is provided inside the wire tire that limits deflection of the tire under load.
Official Gazette of the U.S. Patent Office

N71-27118# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
FAST VALVE OF HIGH PRESSURE FOR BUBBLE CHAMBER
M. P. Balandin, V. I. Ganichev, V. A. Moiseenko, M. I. Solov'ev, V. L. Trifonov et al 1970 12 p ref In RUSSIAN
(JINR-P13-5420) Avail: AEC Depository Libraries

The fast valve, operating at a pressure of 100 atm with a 20-sq cm passage cross section, is described. The plunger is stopped in the valve with the aid of an air damper. To adjust the inpactless stopping of the plunger the valve is equipped with piezoelectric pressure detector. The opening time of the pressing window, at the operating pressure of 5 atm, is 0.005 sec. The valve was tested for reliability. After 500,000 cycles, the air-tightness of all the joints remained within the required limits. Author

N71-27138* Massachusetts Inst. of Tech., Cambridge.
LASER MACHINING APPARATUS Patent
Charles H. Townes, Raymond Y. Chiao, and Elsa M. Garmire, inventors (to NASA) Issued 23 Mar. 1971 9 p Filed 24 Jan. 1969 Cl. 219-121; Cl. 331-94.5; Int. Cl. B23k27/00 Continuation-in-part of US Patent Appl. SN-494739, filed 11 Oct. 1965 Sponsored by NASA
(NASA-Case-HQN-10541-2; US-Patent-3,571,555;
US-Patent-Appl-SN-822068) Avail: US Patent Office CSCL 13I

An apparatus is described for machining a workpiece by electromagnetic energy, preferably laser energy. The apparatus includes a dielectric through which a laser is directed toward the workpiece. At a critical power and wavelength, the dielectric functions as an optical waveguide preventing beam divergence. The apparatus further includes an optical element and position control means for the optical element.
Official Gazette of the U.S. Patent Office

N71-27146* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUSPENDED MASS IMPACT DAMPER Patent
Wilmer H. Reed, III, inventor (to NASA) Issued 9 Mar. 1971 5 p Filed 29 Jan. 1969 Cl. 188-1; Cl. 188-103; Int. Cl. F16f7/10
(NASA-Case-LAR-10193-1; US-Patent-3,568,805;
US-Patent-Appl-SN-794968) Avail: US Patent Office CSCL 13I

A damper mechanism is described for tall and towerlike structures, such as smokestacks and antennas, etc. A suspended mass such as a chain is confined in an enclosure fastened to the primary structure. Vibrations of the primary structure produce opposing movements of the mass and resulting impacts of the mass with the enclosure sides in turn produce a damping force on the primary structure. Official Gazette of the U.S. Patent Office

N71-27147* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PNEUMATIC AMPLIFIER Patent
Arthur G. Trader and Harold I. Johnson, inventor (to NASA) Issued 16 Feb. 1971 5 p Filed 12 Dec. 1968 Cl. 91-390; Cl. 91-461; Int. Cl. F15b13/16; Int. Cl. F15b13/042
(NASA-Case-MSC-12121-1; US-Patent-3,563,135;
US-Patent-Appl-SN-783374) Avail: US Patent Office CSCL 13G

A pneumatic servoamplifier is disclosed for controlling a high pneumatic fluid supply pressure and/or flow capacity to a pneumatically powered system. The high supply pressure is controlled by a low pressure at the control side of the pneumatic amplifier. A small pneumatic decrease pulse at the control side of the pneumatic amplifier delivers a larger increased pulse at the output side of the amplifier. By controlling the pressure in the control side of the amplifier, the supply pressure and/or supply flow rate is controlled to the pneumatic system being operated.
Official Gazette of the U.S. Patent Office

N71-27168* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ACTIVE VIBRATION ISOLATOR FOR FLEXIBLE BODIES Patent
Jack D. Leatherwood, David G. Stephens, and Gray V. Dixon, inventors (to NASA) Issued 2 Mar. 1971 3 p Filed 26 Mar. 1969 Cl. 188-1; Cl. 310-51; Int. Cl. F16f15/02
(NASA-Case-LAR-10106-1; US-Patent-3,566,993;
US-Patent-Appl-SN-810675) Avail: US Patent Office CSCL 13I

An active vibration control arrangement, for isolating a flexible body from disturbances applied either externally or internally by inertial or other forces created by the body itself, is described. The arrangement consists of an actuator with a movable element connected to the moving body. The actuator is controlled by a signal produced by excitatory reaction of the body together with means to produce a nullifying movement of the movable member in response to the signal. Official Gazette of the U.S. Patent Office

N71-27184* Radio Corp. of America, Princeton, N.J.
METHOD AND APPARATUS FOR DISTILLATION OF LIQUIDS Patent
Algerd Basiulis and Paul K. Shefsiek, inventors (to NASA) Issued 16 Feb. 1971 3 p Filed 11 Jan. 1968 Cl. 75-63; Int. Cl. B01d3/12; Int. Cl. C22b9/04 Sponsored by NASA
(NASA-Case-XNP-08124; US-Patent-3,563,727; US-Patent-Appl-SN-697075) Avail: US Patent Office CSCL 13H

A method and apparatus for distillation of materials including liquid metals, having at least one U-shaped tube with one upstream end connected to the device to which the purified metal is to be delivered are described. The material to be purified is disposed in the base of the U while the upstream leg is surrounded with cooling coils for condensation, and the downstream leg has heating coils at a portion thereof for vaporization. The bottom reservoir portion of the U is heated. Between the reservoir portion and the upstream leg of the U within the device is a capillary tube to carry the heated material from the reservoir to the heated region. A series of these tubes can be connected together in continuous fashion to produce a fractional distillation.
Official Gazette of the U.S. Patent Office

N71-27214* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOLDERING DEVICE Patent
Franklin W. Booth, inventor (to NASA) Issued 20 Apr. 1971 3 p Filed 21 Nov. 1968 Cl. 228-53; Cl. 219-229; Int. Cl. B23k3/04
(NASA-Case-XLA-08911; US-Patent-3,575,336; US-Patent-Appl-SN-777764) Avail: US Patent Office CSCL 13I

A soldering tool and method which utilizes controlled capillary attraction of the solder and the tool to regulate solder flow into and out of the tool tip and on and off the workpieces are described.
Official Gazette of the U.S. Patent Office

N71-27335# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MANUFACTURE OF CLAD SHEETS OF VAD23 ALLOY
Yu. N. Ponagaibo 22 Jan. 1971 10 p refs Transl. into ENGLISH from Alyumin. Splavy (Moscow), no. 5, 1968 p 165–169
(AD-721034; FTD-HT-23-826-70) Avail: NTIS CSCL 13/8

The investigations conducted showed that to ensure a higher quality weld of the cladding during hot-rolling of VAD23 alloy it is essential to fulfill the following basic technological requirements: the operation of hot-rolling should be divided into two operations carried out after two heatings: a cladding rolling at a temperature of 380-340 degrees C, the purpose of which is to reduce the plastic flow of the aluminum plate at the moment of welding, and a regular rolling of preclad slbs at the temperature of maximum plasticity of the base alloy; heating of milled slabs with the cladding sheets before the first cladding rolling should be done as quickly as possible to prevent surface oxidation of the slab under the cladding sheet; the working shafts of the hot-rolling mill for the cladding-sheet welding operation should be extremely rough-ground to ensure maximum deceleration of the plastic flow of the cladding during its welding due to increased adhesion of the aluminum to the shaft; when carrying out cladding rolling it is essential to completely prevent the dropping of emulsion and oil on the cladding or shafts (working and support), to preclude local cold welding of the cladding; before the initial weld-rolling the working shafts of the hot-rolling mill must be heated to the maximum possible temperature to alleviate adhesion of the cladding material to the working shaft.
Author (GRA)

N71-27372* Rocketdyne, Canoga Park, Calif.
GAS LIQUEFICATION AND DISPENSING APPARATUS Patent
Stanley M. Hirshfield, inventor (to NASA) Issued 23 Feb. 1971 4 p Filed 29 Nov. 1968 Cl. 23-259; Int. Cl. B01l5/00; Int. Cl. F28d1/02 Sponsored by NASA
(NASA-Case-NPO-10070; US-Patent-3,565,584; US-Patent-Appl-SN-780064) Avail: US Patent Office CSCL 13H

An apparatus for condensing a reagent gas and volumetrically dispensing the resultant liquid under isolation conditions is described. The apparatus comprises a volumetrically calibrated transparent container such as a graduate having a side branch liquid outlet arm. This apparatus permits critical dispensing of very small volumes of reagent without the complications of the usual heavy pressure vessels. It is also usable with any of the near cryogenic or cryogenic fluids that are compatible with the materials from which transparent laboratory equipment is fabricated. Further, the provision for inert gas blanketing of the condensed fluid eliminates the probability of contamination in handling or during storage, and refrigerants can be tailored to suit the boiling point of the various fluids at least to liquid nitrogen temperature.
Official Gazette of the U.S. Patent Office

N71-27432* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FORCE-BALANCED, THROTTLE VALVE Patent
Robert W. Riebling, Richard N. Porter, and Allan R. McDougal, inventors (to NASA) Issued 9 Mar. 1971 8 p Filed 18 Mar. 1969 Cl. 60-243; Int. Cl. F02k9/02; Int. Cl. F16k31/12 Sponsored by NASA
(NASA-Case-NPO-10808; US-Patent-3,568,447; US-Patent-Appl-SN-808192) Avail: US Patent Office CSCL 13I

A force-balanced, throttle valve is described which is adapted to respond to a fixed force for imposing selected changes in the flow rates of a stream of fluid. The system is suited for use in pressure systems, such as rocket motor fuel systems, wherein increasing flow rates serve to increase pressures within the system, and is characterized by a throttle plug adapted to be linearly reciprocated to selected meltering positions for establishing variable flow rates for fluid flowing through the valve. A pressure chamber is also used including an actuator adapted to apply a variable force to the plug for urging the plug in a first direction with a first force (varied at a rate commensurate with concurrent changes in system pressures); and a biasing means operatively associated with the throttle plug adapted to act in opposition to the first force for urging the plug in its opposite direction with a variable second force equal to the first force so that a continuous force-balance is achieved between the opposing forces acting on the plug.
Official Gazette of the U.S. Patent Office

N71-27718*# Aerojet Solid Propulsion Co., Sacramento, Calif. Advanced Technical Operations.
DESIGN, FABRICATION, AND TEST OF OMNIDIRECTIONAL FLEXIBLE SEALS FOR THRUST VECTOR CONTROL OF LARGE SOLID ROCKET MOTORS Final Report
E. Y. Wong 10 Jun. 1971 232 p refs
(Contract NAS3-12049)
(NASA-CR-72889) Avail: NTIS CSCL 11A

The design, fabrication, and testing of a large diameter, flight weight, omnidirectional flexible seal which meets the requirements of the 260 in. diameter solid rocket motor are reported. A simplified flexible element for the seal was designed which consisted of uniform, conical shapes of rubber and steel layers. Individual components of the flexible seal were assembled to form the completed unit by secondary bonding in successive steps using an ambient temperature curing adhesive system. Test data confirmed that the seal met the performance requirements predictably and the performance limits exceeded the design requirements.
Author

N71-27754* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ENERGY LIMITER FOR HYDRAULIC ACTUATORS Patent
Charles P. Steinmetz, inventor (to NASA) Issued 9 Mar. 1971 5 p Filed 19 Mar. 1969 Cl. 91-361; Cl. 91-390; Cl. 91-448;

Cl. 60-51; Int. Cl. F15b13/044; Int. Cl. F15b13/16
(NASA-Case-ARC-10131-1; US-Patent-3,568,572;
US-Patent-Appl-SN-808576) Avail: US Patent Office CSCL 13G

A system is described for controlling the speed of hydraulically movable members by limiting the energy applied to the actuators with a hydraulic servo loop. The system is designed to control the speed at which a simulated aircraft control column is returned to its null position, and to return it to this position without destroying the realistic simulated feel imparted to the operator by the control column. This is accomplished by providing at least two fluid flow paths in series with the source of fluid pressure that returns the movable member to its null or neutral position. One flow path provides a constant impedance to fluid flow and another flow path will temporarily provide an additional fluid flow of a low impedance response to fluid pressure exceeding a predetermined level. D.L.G.

N71-27771*# Texas Instruments, Inc., Houston.
DEVELOPMENT OF QUALITY STANDARDS FOR BIPOLAR LSI DEVICES, PHASE 2 Final Report, 1 Mar. 1970–31 Mar. 1971
Apr. 1971 80 p refs
(Contract NAS8-21319)
(NASA-CR-119794; TI-03-71-27) Avail: NTIS CSCL 14D

The parametric and functional characteristics of bipolar large scale integration devices are investigated. The strength of the devices were analyzed in a simulated aerospace environment and design rules were set up. A philosophy for conduction of electrical tests consistent with the high reliability applications of bipolar devices is also discussed. Infrared techniques were used to analyze the devices. E.H.W.

N71-27772*# Ampex Corp., Redwood City, Calif. Research Dept.
STUDIES OF FOIL JOURNAL BEARINGS FOR BRAYTON CYCLE TURBOMACHINERY Final Report
L. Licht 16 Feb. 1971 190 p refs (Contract NAS3-13482)
(NASA-CR-72864; RR-71-02) Avail: NTIS CSCL 13I

A detailed description of the experimental methods which lead to the realization of a foil bearing support for an experimental Brayton cycle turboalternator is given. An attempt was made to construct foil bearings of dimensions commensurate with rigid, tilting pad bearings, and to produce a reliable rotor support with foil bearings reduced in length by a margin of 50%. Attempts were also made to eliminate the need for an elaborate foil lift system and to achieve multiple starts and stops without the aid of external pressurization. Author

N71-27773*# Marquardt Corp., Van Nuys, Calif.
EVALUATION OF DuPONT LRU 488 AS A SEAT SEAL MATERIAL IN THE MARQUARDT R4D ENGINE VALVE Test Report
R. Lynch Jan. 1971 18 p Prepared for JPL
(Contract NAS7-100)
(NASA-CR-118867; S-991) Avail: NTIS CSCL 11A

An evaluation test program on molded elastomeric seat seals of DuPont LRU 488 was conducted. Six molded seals were supplied and two were assembled into two R4D valve seats. Seal surface profiles were traced with a Bendix Proficorder to document the sealing surface interface prior to valve build up. TMC P/N 228683 S/N 027 and 028 valves were assembled. The seat of the S/N 028 valve exhibited satisfactory seal surface attributes while that of the S/N 027 valve appeared eccentric to the seat centerline. Subsequent acceptance testing resulted in excessive leakage of the S/N 027 valve and satisfactory test results with the S/N 028 valve. The S/N 027 valve seat was reworked to replace the seal and insert but a similar eccentric seal face profile and excessive leakage resulted. Machining of the seat to attempt to compensate for the eccentric seal resulted in a seal profile which appeared to be capable of maintaining contact with the valve armature in the closed position, but subsequent leak checking resulted in excessive leakage. The S/N 028 valve was subjected to a cycle and temperature test with valve leakage monitored at specified increments of cycling. After completion of 7500 cycles at ambient temperature and 2500 cycles at 160 F, a leak rate of 6 to 7 scc/min of GN(2) at 100 psig was measured. Subsequent disassembly of the valve disclosed significant loss of the seal material and testing was terminated. Author

N71-27787*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN INVESTIGATION OF OXIDATION RESISTANT SOLID LUBRICANT MATERIALS
Harold E. Sliney 1971 12 p refs Proposed for presentation at the Intern. Conf. on Solid Lubricants; sponsored by the Am. Soc. of Lubrication Engr.
(NASA-TM-X-67845; E-6338) Avail: NTIS CSCL 11H

Research results on solid lubricants for use at high temperatures in air and other gaseous environments are presented. The characteristics of oxide and fluoride lubricants at temperatures up to 1700 F are described. Data are given for fluoride coatings with silicate and other additives incorporated to give improved wear life and better oxidation protection to the substrate metal. Fluoride-metal self-lubricating composites with improved metal oxidation resistance up to 1700 F are discussed. The concept of cast, self-lubricating ceramics is also explored. Author

N71-27801# California Univ., Berkeley. Coll. of Engineering.
OPTIMAL STRENGTH OF ULTRASONICALLY BONDED METALS IN AIR AND VACUUM Final Report
J. Frisch and U. Chang Sep. 1970 109 p refs Sponsored by AEC
(UCRL-13486; FR-MD-70-2) Avail: NTIS

The fundamental bonding mechanisms of ultrasonic welding were discussed on the basis of information accumulated to date, and two basic bond forming processes were suggested and discussed. An optimum weld condition for the electric power inputs was formulated by using elastic and plastic analysis. A semianalytic expression for the optimum electric power input was thus obtained. The validity of the expression was checked by a series of experiments performed with 2024-T351 aluminum and OFHC copper. An expression for the coefficient of friction for an alternating tangential motion was also obtained from this analysis. Finally, the strength characteristics of the welds were discussed and compared for different test conditions and different modes of failure. Author

N71-27810*# SKF Industries, Inc., King of Prussia, Pa. Research Lab.
ADVANCED TURBINE ENGINE MAINSHAFT LUBRICATION SYSTEM INVESTIGATION, PHASE 2. PART 1: BACKGROUND, TEST ELEMENTS AND RESULTS, AND CONCLUSIONS FOR SYSTEM PERFORMANCE Final Report
W. L. Rhoads and L. A. Peacock Jan. 1971 121 p refs
(Contract NAS3-6267)
(NASA-CR-72854; AL69T016-Pt-1) Avail: NTIS CSCL 13I

Ball bearings and face seals for use on Mach 3 aircraft gas turbine engine mainshafts have been evaluated with several selected lubricants in a recirculating oil system having provisions for inert gas blanketing. Testing has been conducted at typical advanced engine load and speed conditions with the seals exposed to 1200 F hot air and a pressure differential of 100 psi. Using M-50 and WB-49 tool steel ball bearings with two fluid lubricants (two heavy paraffinic resin additive and the other with a proprietary antiwear additive) and newly developed hydrodynamic lift design oil seals, it was possible to run 250-hour tests at 650 F bearing outer ring temperatures with no signs of distress. Reliable longer-term inerted operation at representative advanced engine conditions appears to be feasible. Author

N71-27963*# SKF Industries, Inc., King of Prussia, Pa. Research Lab.
ADVANCED TURBINE ENGINE MAINSHAFT LUBRICATION SYSTEM INVESTIGATION. PART 2: DETAILED FACE SEALS PERFORMANCE, MASS SPECTROSCOPIC STUDY OF A TEST FLUID, AND SUPPLEMENTARY TEST DATA Final Report
W. L. Rhoads and L. A. Peacock Jan. 1971 195 p
(Contract NAS3-6267)
(NASA-CR-72873; AL69T016-Pt-2) Avail: NTIS CSCL 11A

Bearings (125 mm bore) and face seals were run successfully for short periods at speeds to 20,000 rpm corresponding to a DN value (product of bearing bore in millimeters and shaft speed in rpm) of 2.5 million and a seal face speed of 550 feet per second. Author (NSA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N71-26900# Naval Ship Research and Development Center, Washington, D.C.
HOLOGRAPHIC APPLICATIONS IN STRESS ANALYSIS Final Report
Surendra K. Dhir and Herbert A. Peterson Mar. 1971 41 p refs
(AD-721115; NSRDC-3627) Avail: NTIS CSCL 14/5

The report describes some applications of the holographic technique to structural analysis. Experiments were conducted to determine the merits and limitations of the holographic technique as applied to photoelastic and structural models. Improvements in techniques are proposed to relax the requirements on rigid body motion during loading and to eliminate the annealing of slices from photoelastic models. A method is also proposed to improve the intelligibility of combined fringe patterns by virtually eliminating the fringes representing the difference of principal stresses. Both theoretical and experimental methods are used to demonstrate the proposed new techniques. The report identifies those problem areas which are of interest to the Navy and can be solved very effectively by the use of holography. Author (GRA)

N71-26997# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
HYDROGEN MASER WORK AT THE NPL
M. J. Bangham and R. W. Donaldson Mar. 1971 14 p refs
(NPL-QU-17) Avail: NTIS

Two hydrogen masers have been built at the National Physical Laboratory and these are being assessed by comparison with laboratory's cesium resonator. First maser was built as experimental model, the second incorporates improvements suggested by experience with the first; it has a vertical beam, the whole resonator is evacuated (not just the storage bulb) and the discharge tube and magnet are in one assembly which can be aligned while the maser is operating. ESRO

N71-27183* Massachusetts Inst. of Tech., Cambridge.
OPTICAL FREQUENCY WAVEGUIDE AND TRANSMISSION SYSTEM Patent
Charles H. Townes, Raymond Y. Chiao, and Elsa M. Garmire, inventors (to NASA) Issued 20 Apr. 1971 9 p Filed 24 Jan. 1969 Cl. 250-199; Int. Cl. H04b 9/00 Sponsored by NASA Div. of abandoned US Patent Appl. SN-494739, filed 11 Oct. 1965
(NASA-Case-HQN-1054-1; US-Patent-3,575,602; US-Patent-Appl-SN-822090) Avail: US Patent Office CSCL 20E

An optical communication system is disclosed in which electromagnetic energy is communicated from a source to a receiver through a gastight structure filled with gas, such as carbon dioxide, at a selected pressure. The energy is of a first frequency and with a critical power value P sub c so that the energy which passes through the gas is trapped in the form of a constant diameter beam. The energy also includes modulated electromagnetic energy at a critical power value less than P sub c1 but at a frequency higher than the first frequency, whereby the modulated energy is also trapped in the beam as it passes through the gas-filled structure. Official Gazette of the U.S. Patent Office

N71-27189# New York Univ., N.Y. Dept. of Physics.
LASER TRIPLE QUANTUM PHOTOIONIZATION OF CESIUM Technical Report, Jun. 1967 – Mar. 1971
Robert A. Fox, Robert M. Kogan, and Edward J. Robinson Mar. 1971 9 p refs
(Contract N00014-67-A-0467-0002)
(AD-721091; TR-1) Avail: NTIS CSCL 7/4

A report is given of observations of the ionization of atomic cesium by the simultaneous absorption of three ruby laser quanta. The results appear to be in qualitative agreement with theory, and indicate that circularly polarized light produces ionization about twice as efficiently as linearly polarized light, suggesting a new kind of polarized electron source. Author (GRA)

N71-27395# Naval Research Lab., Washington, D.C.
THERMAL BLOOMING OF LASER BEAMS IN GASES Final Report
J. N. Hayes 11 Feb. 1971 38 p refs
(AD-720311; NRL-7213) Avail: NTIS CSCL 20/5

The trajectories of light rays and the intensity pattern of a laser beam as a function of time and of distance down the beam are determined. It is assumed in this calculation that (a) the medium is a homogeneous, isotropic, and initially quiescent gas, (b) convection, viscosity, and thermal conduction may be ignored at early times, (c) changes in total beam power as a function of distance downbeam may be ignored, (d) a specific model of energy deposition is valid, (e) the medium may be described by equations of hydrodynamics and thermodynamics and obeys the Lorentz-Lorenz Law, and (f) geometrical optics applies to the problem. It is shown that this model can be solved exactly; long- and short-time behavior of the solutions is discussed, and the times for the onset of convection are estimated. The phenomenon of laser defocusing is shown to change rapidly with time; a definition of thermal blooming is given, and it is shown that the region of blooming moves up the beam toward the face of the laser. The intensity pattern at a fixed point in space is shown to change its profile, going over to a bright narrow annular ring whose radius increases with the passage of time. Parameter combinations required for studies of various aspects of the blooming phenomenon are pointed out as the mathematical development progresses. Author (GRA)

N71-27404# Naval Training Device Center, Orlando, Fla.
LASER SAFETY
Windell Neil Mohon Nov. 1970 45 p refs
(AD-721088; NAVTRADEVCEN-IH-181) Avail: NTIS CSCL 13/12

A literature survey of the most recent laser safety parameters and precautions is presented. Recent laser safety legislation is discussed. The basic features of a laser are discussed. Recommended safe exposure levels are given for the eye and skin. Models are discussed for the eye and skin. Damage thresholds are listed for the eye and skin. Formulas are derived for calculating laser radiation exposure levels. Hazards associated with laser operation are discussed and recommendations are made. The contents for a basic laser safety program are presented. This program includes the basic opthalmologic and dermatologic tests which should be given to personnel. Author (GRA)

N71-27808 Tomsk State University (USSR).
EXPERIMENTAL STUDY OF RADIATION ATTENUATION IN THE ATMOSPHERE USING LASERS
B. A. Antipov, V. E. Zuev, A. V. Sosnin, V. A. Sapozhnikova, and S. S. Khmelevtsov *In* WMO Radiation Including Satellite Tech. 1970 p 151–153 (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

Measurements of laser radiation absorption coefficients at 1.15 and 3.39 microns have been carried out using a multipath cell. The air pressure in the cell could be varied from one atmosphere to 1 millimeter of mercury. Measurements of the ground layer for various laser radiations are also reported. The radiation attenuation coefficients are found to be equal to the scattering coefficients. ESRO

N71-27812# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPERATING CHARACTERISTICS OF A NEODYMIUM GLASS LASER
N. V. Gretsev et al 18 Dec. 1970 9 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (Moscow), no. 3, 1969 p 20–22
(AD-720950; FTD-HT-23-876-70) Avail: NTIS CSCL 20/5

A dependence of operation characteristics of the Nd glass laser on the frequency of pumping pulses was followed experimentally. The investigation was carried out on the active element of a LPS-28-2 Nd glass. An ISPT-6000 pumping lamp was used. The active element and the pumping lamp were cooled with a given aqueous solution at 20 degrees. Other experimental settings were: distance between mirrors of the resonator 210 mm; a given frequency of pumping pulses; duration of the pulses 1-8 mu sec. A dependence of the radiation energy on the frequency of pumping pulses exhibits a max., a position of which is practically independent of the pumping energy. For the laser described, a maximum radiation energy in the periodic regime of operation was observed, when the pumping energy was set to the value corresponding to the threshold pumping energy in the single-frequency regime. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N71-26812# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEFORMATION OF 5VMTs-TYPE ALLOYS
Ya. M. Okhrimenko et al 7 Dec. 1970 11 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), v. 12, no. 5, 1969 p 75–78
(AD-720932; FTD-MT-24-230-70) Avail: NTIS CSCL 11/6

A study was made of the effect of the addition of carbon on the technology of pressure treatment of the 5VMTs alloy, the carbon being a strengthener because of the separation of the second phase, in determining the optimum degrees of forging, the mechanical features and research on the conditions of thermal treatment of the obtained sheet material. Author (GRA)

N71-26907# Atomic Energy Commission, Washington, D.C.
PROPERTIES OF HEAT RESISTANT STEELS FOLLOWING HIGH TEMPERATURE REACTOR RADIATION
S. N. Votinov et al Feb. 1971 12 p Transl. into ENGLISH of Russian report
(AEC-tr-7192) Avail: NTIS

Results of investigation of radiation embrittlement of age-hardening steels with different intermetallic hardening are reported. The strength characteristics critical point and apparent yield limit over the entire temperature range are substantially lower for irradiated steel and the steels subject to annealing by the irradiation process, compared with the strength values for steel in the original state. For irradiated steel tested in open heating at a temperature close to 350 C, the beginning of a bulge can be observed, characteristic of strain aging. The same temperature range shows a beginning decrease in the plasticity of the steel in inverse proportion to the temperature increase. NSA

N71-26911*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ARTIFICIAL METEOR ABLATION STUDIES: IRON OXIDES
Maxwell B. Blanchard May 1971 37 p refs
(NASA-TM-X-62025) Avail: NTIS CSCL 11F

Artificial meteor ablation was performed on natural minerals, composed predominately of magnetite and hematite, using an arc heated plasma stream of air. Analysis of the ablated debris indicates most was composed of two or more minerals. Wustite, a metastable mineral, was found to occur as a common product. The magnetite model, whose content was 80% magnetite, 14% hematite, 4% apatite, and 2% quartz, yielded ablated products consisting of over 12 different minerals. Magnetite occurred in 91% of all specimens examined, hematite in 16%, and wustite in 39%. The hematite model, whose content was 96% hematite and 3% quartz, yielded ablated products consisting of over 13 different minerals. Hematite occurred in 47% of all specimens examined, magnetite in 60% and wustite in 28%. The more volatile elements (Si, P, and Cl) were depleted by a reduction of about 50% in the amounts present. Also, the relative abundance of Fe increased as a result of both volatile depletion (loss of Si, P, Cl, and Ca) and a reduction in its oxidation state. Hematite was converted to magnetite in the ablation zone along the model's front face. Also, quartz and apatite minerals were converted to an Fe-rich glass consisting of varying amounts of Si, P, Cl, and Ca, depending upon the accessory minerals available at the time of melting. Author

N71-26918# Northwestern Univ., Evanston, Ill.
EFFECT OF ELECTRON IRRADIATION ON THE STRENGTH OF IRON SINGLE CRYSTALS
A. Sato, T. Mifune, and M. Meshii [1970] 5 p refs Presented at the 2d Intern. Conf. on the Strength of Metals and Alloys, Pacific Grove, Calif., Sep. 1970 Sponsored by AEC
(COO-1367-36; CONF-700819-11) Avail: NTIS

The effects of electron irradiation on the strength of monocrystalline bcc iron were studied. Experimental and calculated results strongly supported the contention that the inherent lattice hardening determined the low temperature strength of pure iron and perhaps other pure bcc metals. Dilute impurities would cause the softening effect and the impurity hardening effect could be expected only above a critical concentration. The hardening effect found after the electron irradiation and aging was not clearly understood, since the distribution of the radioinduced defects became uncertain after the aging. NSA

N71-26919# California Univ., Berkeley. Lawrence Radiation Lab.
LECTURE 3: NONEQUILIBRIUM DEFECTS IN METALS
G. Thomas Sep. 1970 38 p refs Presented at the 2d Intern. Conf. on the Sci. of Mater., Tremezzo, Italy
(Contract W-7405-eng-48)
(UCRL-19696; CONF-700934-3) Avail: NTIS

A brief outline of individual defects in metals and their interactions and associations is presented. Discussions are included on point defects, line defects, dislocation origins, dislocations occurring during solidification, nucleation of dislocations from impurities, dislocation multiplication, surface defects, and volume defects. NSA

N71-26921# WADCO Corp., Richland, Wash.
IRRADIATION PRODUCED DEFECTS IN AUSTENITIC STAINLESS STEEL
H. R. Brager, J. L. Straalsund, J. J. Holmes, and J. F. Bates Dec. 1970 48 p refs
(Contract AT(45-1)-2170)
(WHAN-FR-16) Avail: NTIS

The microstructure of annealed AISI Type 304 and Type 316 stainless steels was characterized by transmission electron microscopy as a function of fast reactor irradiation. Several irradiation produced defect types were found: voids, Frank faulted loops, perfect loops, dislocation networks, and precipitates. Void number density obeyed a power law relationship to fluence, wherein the exponent increased with increasing temperature and had a mean value near unity. The void size was nearly independent of fluence and increased with increasing temperature. The upper limit irradiation temperature for void formation was about 650 to 700 C. The density and size of Frank faulted loops followed trends similar to those found for voids to temperatures of approximates 550 C where unfaulted loops, perfect loops, and dislocation networks coexisted. These experimental results do not confirm predictions of recently advanced models of void formation. Author (NSA)

N71-26947*# General Electric Co., Cincinnati, Ohio.
CORROSION RESISTANCE OF TANTALUM, T 111, AND Cb-1Zr TO MERCURY AT 1200 F
L. B. Engel, Jr. and R. W. Harrison Washington NASA May 1971 25 p ref
(Contract NAS3-10610)
(NASA-CR-1811; GESP-199) Avail: NTIS CSCL 11F

Sheet specimens of tantalum, T-111, and Cb-1Zr were strained 5 and 20 percent by bending. Specimens representative of each strain level, and in the as-bent and the as-bent and annealed conditions, were tested at 1200 F for 1000 hours in sealed tantalum capsules containing liquid mercury. No changes were observed in any of the specimens as a result of the exposure to mercury. Author

N71-26966# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
OPTICAL ABSORPTION OF METALS IN THE X-UV RANGE
C. Kunz Sep. 1970 18 p refs
(DESY-70/48) Avail: AEC Depository Libraries

The absorption spectra in the soft X-ray range show features which are commonly not found in the ordinary X-ray region. Several typical shapes of the absorption are discussed with examples of measurements which were obtained with synchrotron radiation from the 7.5 GeV electron accelerator DESY. The shift of oscillator strength to higher energies and the frequent absence of edge discontinuities is discussed with Au as an example. The atomic calculations give good overall agreement but are unable to explain broad prominent peaks in several light metals (Na, Mg, Al). Moreover, in these metals the electron hole interaction gives rise to a prominent narrow peak near the edge. Interchannel interaction appears to have an important influence on transition metal spectra (Ti to Ni). Author

N71-26990# WADCO Corp., Richland, Wash.
EBR-2 IRRADIATION EFFECTS OF RUPTURE OF TYPE 316 STAINLESS STEEL
R. W. Barker and J. J. Holmes 1 Jul. 1970 11 p refs Presented at the Meeting of the Am. Nucl. Soc., Washington, D.C. Sponsored in part by AEC
(WHAN-SA-2; CONF-701102-7) Avail: NTIS

The effects of EBR-2 irradiation on the biaxial stress-rupture properties of annealed Type 316 stainless steel were investigated at test temperatures of 1000, 1200, and 1400 F. The composition of the tubing was as follows: 0.081%C, 2.3%Mo, 1.5%Mn, 13.2%Ni, 17.0%Cr, and 0.5%Si. The EBR-2 irradiation produced a loss in rupture strength and ductility at all test temperatures and an increase in creep rate at 1000 F. Stress-to-rupture values were reduced about 20% at a test temperature of 1000 F; at 1200 F a 10% loss in strength occurred while at 1400 F the stress-to-rupture was reduced 25%. Ductility was reduced as much as a factor of 0.1 depending on test temperature and test duration. The greatest losses in ductility occurred at 1000 and 1400 F with little effect occurring at 1200 F. Dorn's theta parameter was used to correlate stress rupture data and to describe fracture mode and precipitation. Author (NSA)

N71-26998# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MAGNETIC PROPERTIES OF CHROMIUM AND VANADIUM NITRIDE MIXTURES [PROPRIETES MAGNETIQUES DES NITRURES MIXTES DE CHROME ET DE VANADIUM]
Francois Ducastelle and Paul Costa 1969 13 p refs In FRENCH Submitted for publication
(ONERA-TP-719) Avail: NTIS

Physical properties of chromium nitrides are compared with those of other nitrides formed with corresponding metals in column IVa and Va in the periodical classification. The magnetic permeability of chromium nitride/vanadium nitrides binary mixtures are discussed as a function of temperature and concentration. ESRO

N71-27007# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.
CREEP AND CREEP STRENGTH OF VANADIUM-TITANIUM AND VANADIUM-TITANIUM-NIOBIUM ALLOYS WITH ADDITIONS OF SILICON AND GERMANIUM [ZEITSTAND- UND KRIECHVERHALTEN VON VANADIN-TITAN- UND VANADIN-TITAN-NIOB-LEGIERUNGEN MIT ZUSAETZEN VON SILIZIUM UND GERMANIUM]
H. Scholz and M. Schirra May 1970 41 p refs In GERMAN; ENGLISH summary
(KFK-1193) Avail: AEC Depository Libraries

The creep behavior of alloys composed of V-3Ti, V-3Ti-1Si, V-3Ti-1Ge, -2Ge, -4Ge, and V-3Ti-5Nb-1Si was investigated, at a temperature of 850 C and under a vacuum of 10(−4) torr; the creep behavior of the V-3Ti-15Nb-1Si alloy was investigated at the temperatures of 650, 750, 800, and 850 C. The creep rupture strength of the V-3Ti alloy was about 6 kg/sq mm after 1000 hours. Germanium alloying did not result in a considerable increase in strength. A major increase in strength was attained by adding 1% of Si to the V-3Ti alloy; however, the high strength of the V-3Ti-1Si alloy was attributed to the high oxygen content of 2900 ppM. The strength was also enhanced by the solid solution hardening element, niobium. Cracks were not observed in the vanadium alloys unless the samples were embrittled on the surface by chemical reactions. A change in the creep mechanism was observed for the alloy V-3Ti-15Nb-1Si in the temperature range between 650 and 750 C. Up to 650 C, dislocation movements are rate-determinant, while diffusion processes dominate above 750 C. Author (NSA)

N71-27017# California Univ., Berkeley.
PREDICTION OF FATIGUE LIVES OF 2024-T3 AND 6061-T6 ALUMINUM ALLOYS UNDER BROAD BAND RANDOM EXCITATION Final Report
J. Lucke and G. W. Brown Feb. 1971 320 p refs Prepared for Sandia Corp., Livermore, Calif.
(SCL-CR-710175) Avail: NTIS HC$6.00/MF$0.95

A method is presented for predicting the fatigue lives of 2024 T3 and 6061 T6 aluminum alloys subjected to either constant amplitude sinusoidal or wide band random fatigue loadings. The accumulation of damage due to cyclic loadings is formulated in terms of the propagation of a dominant fatigue crack in a structure.

The fatigue life is determined by calculating the critical value of the crack length when the structure can no longer support its load. The crack propagation model is developed and applied to the problem of predicting the fatigue life of a cantilever beam specimen which is subjected to either a constant amplitude sinusoidal or a wide band random base excitation. The first two natural frequencies of the cantilever beam are excited. An experimental program is presented which determines all the necessary empirical parameters and verifies many of the theoretical predictions. Close agreement between the experimental data and the theoretical fatigue life predictions was found. Author

N71-27040# Northwestern Univ., Evanston, Ill. Technological Inst.

CHARACTERIZATION, SELECTION, AND USE OF HIGH STRENGTH STEELS

W. S. Owen *In* AGARD The Characterization and Appl. of Mater. May 1971 19 p refs (See N71-27038 15-18)

Avail: NTIS

The principles and ideas on which modern ultra-high strength steels have been developed are outlined and a few concepts of basic importance are illustrated by a description of specific alloys and thermal and mechanical treatments which are applied to them. Considered exclusively are those alloys intended to possess a very high strength, as defined by the yield stress or the flow stress, at a small offset (less than 0.2% strain) combined with acceptable ductility. It is assumed that components made from these steels are subjected to static loading, a slow applied strain rate or very low frequency cyclic loading at temperatures within 100 degrees of room temperature. Of primary importance is the resistance of these alloys to stress corrosion and related effects. Most of the features of the structure of importance in this context are those which can be studied by optical microscopy. Author

N71-27045# Societe Trefimetaux, Argenteuil (France).

CHARACTERIZATION, SELECTION AND USE OF TITANIUM BASE ALLOYS [CARACTERISATION, SELECTION ET UTILISATION DES ALLIAGES DE TITANE]

R. Syre *In* AGARD The Characterization and Appl. of Mater. May 1971 46 p refs In FRENCH and ENGLISH (See N71-27038 15-18)

Avail: NTIS

The advantages of titanium alloys are based primarily on their mechanical property/density ratio developed by addition of alloying elements and heat treatments. Alloy selection for the two major applications (airframes and jet engines) is based on stringent characterization criteria, such as fracture toughness, stress corrosion resistence and fatigue strength, in addition to creep resistance, low cycle fatigue strength and thermal stability for jet engine design. Fasteners, hydraulic tubings and castings provide new areas of application for titanium. Engineering properties vary strongly with the alloy microstructure. Author

N71-27068# Virginia Polytechnic Inst., Blacksburg. Dept. of Metals and Ceramic Engineering.

THE RELATIONSHIP OF NITROGEN CONTENT TO THE SUSCEPTIBILITY OF AUSTENITIC STAINLESS STEELS TO STRESS CORROSION Quarterly Report, 1 Sep.–30 Nov. 1970

G. S. Clevinger and Jack L. Lytton Jan. 1971 23 p refs

(Contract AT(40-1)-4052)

(TID-256664; OR-2) Avail: NTIS

Continuing studies on crack propagation and strength of stainless steels are reported. Equations describing crack propagation are developed and analyzed. It was determined that scanning electron microscopy must be used to investigate crack initiation. Yield and tensile strength of annealed Type 304 stainless steel were found to be 24,500 and 57,000 psi, respectively, when tested at a strain rate of 0.03/min. Initial efforts at nitriding 20Cr-20Ni stainless steel are mentioned. N.E.N

N71-27116# Vermont Univ., Burlington.

THERMODYNAMIC AND TRANSPORT PROPERTIES OF INTERSTITIAL HYDROGEN ISOTOPES IN PALLADIUM Progress Report, 1 Apr.–15 Dec. 1970

John S. Brown 15 Dec. 1970 6 p refs

(Contract AT(30-1)-4062)

(NYO-4062-5) Avail: NTIS

Research is reported on conduction electron propagation in pure Pd and the use of the T-matrix and pseudopotential formalisms to obtain an electron-ion matrix element, and on electron propagation in disordered alloys. Recently published interpolation parameters are being used to construct an effective electron-ion potential for pure Pd which will include the effects of a proper hybridization of the 5s and 4d states anf d-state resonance effects. A coherent potential approximation model, muffin-tin potentials, and their application to the interstitial alloy PdH(n) are described briefly. N.E.N.

N71-27117# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

EFFECT OF A beta YIELDS alpha TRANSFORMATION AND OF OXYGEN ON PLUTONIUM DISTRIBUTION IN DILUTE Zr-Pu AND Ti-Pu ALLOYS [INFLUENCE DE LA TRANSFORMATION beta rendement alpha ET DE L'OXYGENE SUR LA REPARTITION DU PLUTONIUM DANS LES ALLIAGES Zr-Pu ET Ti-Pu DILUES]

Alain Languille, Clotilde Remy, and Daniel Calais 1970 16 p refs In FRENCH Presented at Meeting on Met., Paris, 28 Sep.–2 Oct. 1970 Submitted for publication

(CEA-CONF-1691; Conf-700904-4) Avail: AEC Depository Libraries

Allotropic alpha yields beta transformations in Ti and Zr of the martensitic type were studied. After a sufficiently rapid beta yields alpha transformation, micrographic observation revealed a needle structure whose direction varied in relation to the relative positions of the beta grains in the previous phase. Some segregation in solute appeared with dilute PuTi, PuZr, and UTi alloys after heating at a temperature superior to that of the transformation for the pure metal. Each beta grain led, after cooling, to a series of alpha needles, whose orientation was well defined. X-ray microanalysis and alpha autoradiography revealed the needles to be alternatively deficient and enriched with beta active solute. The zones may vary between 1 and 10. The macroscopic and anisotropic displacement of the solute atoms observed cannot be explained by only thermal diffusion accounting for the diffusion coefficients and the cooling rate during the phase change. Two hypotheses were proposed to explain the phenomena: an accelerated diffusion resulting from the super-saturation in point defects caused by the phase change; contamination by alpha active oxygen. NSA

N71-27128# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

CHEMICAL DIFFUSION AND HETERODIFFUSION AT INFINITE DILUTION OF Pu IN BODY CENTERED CUBIC beta Ti [DIFFUSION CHIMIQUE ET HETERODIFFUSION ADILUTION INFINIE DU PLUTONIUM DANS LE TITANE beta]

Alain Languille 1970 14 p refs In FRENCH Presented at Meeting on Met., Paris, 28 Sep.–2 Oct. 1970 Submitted for publication

(CEA-CONF-1687; Conf-700841-8) Avail: AEC Depository Libraries

The Pu–Ti phase diagram presents a body centered cubic TiPu beta solid solution ranging from 0 per cent to 50 per cent Pu by weight at 900 C. Heterodiffusion at infinite dilution of Pu in this phase was carried out on structure of beta

titanium where diffusion is concerned. In the case of chemical diffusion, the diffusion coefficient alloys containing 0.3 per cent and 3 per cent by weight of Pu. The examinations are made by X-ray microanalysis and autoradiography. The results obtained between 900 and 1200 C give a very low activation energy of the order of 20 kcal, which confirms the abnormal body-centered cubic structure diffusion, the diffusion coefficient depends little on the concentration although the slope of the liquidus curve is steep.
Author (NSA)

N71-27129# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
CRYSTALLOGRAPHIC ANALYSIS OF THE SEGREGATIONS OBSERVED IN DILUTE ZrPu ALLOYS DURING MARTENSITIC TRANSFORMATION [ANALYSE CRISTALLOGRAPHIQUE DES SEGREGATIONS OBSERVEES AU COURS DE LA TRANSFORMATION MARTENSITIQUE DANS LES ALLIAGES ZIRCONIUM-PLUTONIUM DILUES]
Jean-Francois Cornet and Daniel Calais 1970 21 p refs In FRENCH Presented at the Meeting on Met., Paris, 28 Sep.-2 Oct. 1970 Submitted for publication
(CEA-CONF-1688; CONF-700941-1) Avail: AEC Depository Libraries

Zirconium alloys with small Pu contents in the beta phase (bcc) were studied. After heat treatment segregations appeared. The form of the segregations demonstrated that the diffusion anisotropy was due to the martensitic nature of the Zr beta yields alpha phase change. In order to confirm this the following two approaches were adopted: A 3 per cent ZrPu alloy which had been quench hardened when in the beta phase was analyzed using X-ray crystallography; this sample did not exhibit segregation because the rate of cooling had been too rapid; a 0.3 per cent ZrPu alloy which had been slowly cooled was similarly analyzed; the macroscopic segregation observed in the solute was attributed to an anisotropic diffusion phenomena. The microscopic and X-ray crystallographic data obtained were compared and discussed.
NSA

N71-27130# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STRUCTURE TRANSFORMATIONS OF ZrCu BINARY ALLOYS WITH LOW Cu CONTENTS AND TERNARY ALLOYS DURING CONTINUOUS COOLING [TRANSFORMATIONS STRUCTURALES EN REFROIDISSEMENTS CONTINUS D'ALLIAGES ZIRCONIUM-CUIVRE A FAIBLES TENEURS ET D'ALLIAGES TERNAIRES DERIVES]
Jacques Decours, Gilbert Brun, and Denis Gratias Sep. 1970 23 p refs In FRENCH
(CEA-N-1310) Avail: AEC Depository Libraries

The phase transformations occurring in the beta phase of Zr-Cu binary alloys (Cu = 0.5 to 2.33%) and ternary alloys (Zr-0.5% Cu-0.5% Mo; Zr-2% Cu-0.5% Mo; Zr-2% Cu-0.5% Ni; Zr-2% Cu-0.5% Cr) during continuous cooling were investigated using different physical methods such as thermal analysis, dilatometry, and optical and electron microscopy.
Author (NSA)

N71-27132# Dow Chemical Co., Golden, Colo.
RECOVERY OF NIOBIUM FROM NIOBIUM-URANIUM ALLOYS: AN ANNOTATED BIBLIOGRAPHY
James D. Navratil 4 Feb. 1971 43 p refs
(Contract AT(29-1)-1106)
(RFP-1421) Avail: NTIS

Two hundred sixty-seven references, with resumes, are presented in 4 sections: alloy dissolution, alloy separation, niobium metal preparation, and refining of niobium. A subject index, book listing, index of organizational symbols, and author index are provided.
NSA

N71-27212# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
ELECTRONIC SPECIFIC HEAT OF NOBLE AND TRANSITION METAL ALLOYS Final Summary Report, 1 Jul. 1969-31 Dec. 1970
John A. Rayne 31 Jan. 1971 6 p refs
(Grant AF-AFOSR-1765-69)
(AD-720885; AFOSR-TR-71-0740) Avail: NTIS CSCL 11/6

A brief summary is given of experiments which concerned low temperature specific heat measurements on AuSb2, AuSn and ternary copper-silver-gold alloys. The latter data support the theory of Stern and show that electron-phonon enhancement effects are small.
Author (GRA)

N71-27213# Battelle Memorial Inst., Columbus, Ohio.
FUNDAMENTAL CHARACTERISTICS OF DYNAMIC SLIP-BAND PROPAGATION Final Technical Report
J. D. Boyd, G. T. Hahn, M. F. Kanninen, and A. R. Rosenfield 17 Mar. 1971 7 p refs
(Grant AF-AFOSR-1719-69)
(AD-720883; AFOSR-TR-71-0722) Avail: NTIS CSCL 11/6

High strain-rate deformation of niobium single crystals is accommodated by a combination of twinning and slip. At a high strain rate more slip systems are activated than at a low rate, and the slip is more homogeneous in character. The edge components of the glide dislocations are more mobile than the screws at a high strain rate, and are rapidly exhausted from the crystal during straining. Neither primary edges or screws react much with secondary dislocations at high strain rates, hence, there is no tendency for dislocations walls to develop during straining. By contrast, at a low strain rate primary dislocations react strongly with secondary dislocations to produce segments of sessile a (001) dislocations. Consequently, a stable array of dislocation walls develop during straining. Subsequent dislocation movement is concentrated in the vicinity of the dislocation walls, and slip becomes markedly non-homogeneous.
Author (GRA)

N71-27218# Japan Atomic Energy Research Inst., Tokyo.
THE EFFECT OF COLD WORKING ON CREEP PROPERTIES OF AISI 316 TYPE STAINLESS STEEL
Teruo Furuta, Yutaka Ogawa, and Rukichi Nagasaki Aug. 1970 29 p refs In JAPANESE; ENGLISH summary
(JAERI-Memo-4125) Avail: AEC Depository Libraries

Austenitic stainless steel is to be used as fuel cladding materials in the fast breeder reactor. It is noted that creep properties of stainless steel are well known, but little information is available on fuel cladding applications where stress is low and tubes are thin-walled. The investigation revealed that at the temperature of 650 C, secondary creep rate reached the minimum at about 10% prior to cold working at 4 to 8 kg/sq mm stress range. At the temperature of 750 C, where recovery controls creep behavior of steel, secondary creep rate increased with prior cold working at the same stress range.
Author (NSA)

N71-27222# Iowa State Univ. of Science and Technology, Ames.
MECHANICAL PROPERTIES OF SOME NICKEL-COPPER AND NICKEL-COPPER-CARBON ALLOY BELOW 0.35 T SUB m
Robert Paul Zerwekh (Ph.D. Thesis) Nov. 1970 123 p refs
(Contract W-7405-ENG-82)
Avail: NTIS

The mechanical properties of a series of polycrystalline nickel-copper and nickel-copper-carbon alloys were studied at 5 temperatures in the range between 78 and 523 K. In the low carbon (Series I) alloys, copper compositions were 0, 15, 30, 45, and 60 a/o. Series II consisted of the same copper levels but also contained 0.2 a/o C, which had been quenched in. Mechanical testing of the 10 alloys included stress-strain and instantaneous strain rate change tests. Flow-stress versus temperature curves

showed a relatively strong temperature dependence below about 300 K in the Series II alloys containing 15, 30, 45, and 60 a/o Cu. In addition, the strain rate sensitivity parameter when plotted as a function of temperature, exhibited a maximum between 200 and 300 K at 2% engineering strain. In the high carbon alloys, the maximum could be eliminated by work hardening. Author

N71-27252# Japan Atomic Energy Research Inst., Tokyo.
CREEP AND CREEP RUPTURE TESTS OF A DOMESTIC SUS 32 (AISI TYPE 316) STAINLESS STEEL AS A STRUCTURAL MATERIAL OF FAST BREEDING REACTOR Collaboration Report, 1967–1969
S. Yokoi (Natl. Res. Inst. for Metals), Y. Monma (Natl. Res. Inst. for Metals), H. Namatame, and T. Kodaira 10 Jun. 1970 49 p refs In JAPANESE; ENGLISH summary
(JAERI-Memo-4097) Avail: AEC Depository Libraries

Results of creep and creep-rupture tests of domestic SUS 32 (AISI Type 316) stainless steel are presented. The creep test was made at 500, 550, and 600 C on the specimens taken from heavy thickness plates (t = 30mm) and the creep-rupture test was made on the specimens of 316 stainless steel and their weld metals at 500 and 600 C. It was found that in creep tests on two different lots one material showed a faster minimum creep rate at 500 and 550 C than the other. However, this tendency was reversed at 600 C. Adding nitrogen and niobium to 316 stainless steel as alloying elements was highly effective in increasing the creep-rupture strength. The rupture time of weld-metal specimens was about one order lower than the base metals at the same stress level at 600 C. All materials tested had good ductility at rupture. Creep properties of all materials tested satisfied the criteria of ASME Boiler and Pressure Vessel Code, Section 8. Author (NSA)

N71-27257 Missouri Univ., Rolla.
A STUDY OF THE ANODIC OXIDATION OF ACETYLENE ON PLATINUM-GOLD ALLOYS
Christopher Kuo-Chieh Wu (Ph.D. Thesis) 1969 153p
Avail: Univ. Microfilms Order No. 70-11766

The anodic oxidation of acetylene on Pt-Au alloys of four compositions (80-20, 60-40, 40-60, and 20-80 Pt-Au) was studied at 80 C in solutions of constant pH and unit normality. Currents were measured as a function of potential and partial pressure of acetylene. The effects of temperature on current in 1 N H_2SO_4 and 1 N NaOH and the coulombic efficiencies for CO_2 production were determined. The experimental results indicated that the alloys can be classified into three groups, Pt-rich, Au-rich and intermediate compositions. A transition region (change of the mechanism) was found for the Au-rich alloys. The oxidation can be interpreted in terms of two mechanisms. The total current on the heterogeneous phases can be represented as the sum of the currents on the phases. Dissert. Abstr.

N71-27301# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CORRESPONDENCE OF HYDROABRASIVE WEAR RESISTANCE AND THE HARDNESS OF HEAT TREATED STEELS
M. M. Khrushchov 30 Nov. 1970 9 p refs Transl. into ENGLISH from Mashinostr., Nauchn. Tekhn. Sb. (Kiev), no. 6, 1969 p 103–105
(AD-721022; FTD-HT-23-731-70) Avail: NTIS CSCL 11/6

The results of a study made of the abrasive wear of various types of structural steel caused by friction against fixed abrasive particles (an abrasive cloth), carried out by the author and a collaborator, are confirmed by research carried out in Switzerland on a hydroabrasive-wear machine. The results of the Swiss tests are compared with the previously mentioned results of the author. Author (GRA)

N71-27308 Stanford Univ., Calif.
THE EFFECTS OF PLASTIC DEFORMATION OF AUSTENITE ON THE MARTENSITIC TRANSFORMATION IN Fe-Ni-C ALLOYS
Jose Roberto Costa Guimaraes (Ph.D. Thesis) 1969 114 p
Avail: Univ. Microfilms Order No. 70-10445

The effects of prior plastic deformation of austenite on the nucleation of martensite during subsequent cooling, and the morphology of martensite of deformation formed during cold rolling of austenite were studied. The athermal nucleation of martensite was studied primarily by observing variations in the temperature at which the martensite transformation starts during cooling. M sub s temperatures were measured by a resistometric method. The morphology of martensite of deformation was studied by means of optical microscopy and by replica and transmission electron microscopy. It was observed that plastic deformation of austenitic specimens performed at room temperature and at 200 C deformation in the specimens does not appear to affect the subsequent martensite transformation upon cooling. No evidence was found that strain hardening of the austenite causes mechanical stabilization of the austenite. Dissert. Abstr.

N71-27327 Cornell Univ., Ithaca, N.Y.
MATERIALS BEHAVIOR AND STRUCTURAL PERFORMANCE OF TEMPERED AUSTENITIC STAINLESS STEEL
Shien Tsun Wang (Ph.D. Thesis) 1969 294 p
Avail: Univ. Microfilms Order No. 70-5813

A detailed investigation of material properties of cold worked stainless steel is made. A statistical approach is introduced to study the variation of yield strength due to cold working so that lower bound values may be established. An affinity approach is introduced to obtain the shear properties from normal stress behavior. Design mechanical properties for tempered Type 301 are obtained. The buckling and post buckling behavior of stiffened and unstiffened elements as a part of the structural member is investigated. The nonlinear and anisotropic material properties are considered in the approximate analyses. Bleich's two modulus concept of inelastic buckling and Von Karman's effective width concept of post buckling strength were used for predicting the element behavior. A numerical analysis of the inelastic flexural behavior of thin-walled cold formed members with considerations of the unique material properties is made by using a digital computer. Simplified methods are also recommended for design purposes. Dissert. Abstr.

N71-27350# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
DETERMINATION OF LIMITING SOLUBILITIES USING HETERODIFFUSION COEFFICIENT MEASUREMENTS [DETERMINATION DES PETITES LIMITES DE SOLUBILITE PAR DES MESURES DE COEFFICIENTS D'HETERODIFFUSION]
Jean-Pierre Zanghi, Annick Van Craeynest, and Daniel Calais 1970 15 p refs In FRENCH Presented at Meeting on Met., Paris, 28 Sep.–2 Oct. 1970
(CEA-CONF-1689; CONF-700941-5) Avail: AEC Depository Libraries

Using the coefficients of heterodiffusion and the Jost method, the solubility of U in Ni was measured. Heterodiffusion coefficients for U in Ni at infinite dilution were obtained using the technique of making a thin deposit of U, between two semi-infinite Ni media, by evaporation under vacuum. The concentration-penetration curves were determined. The diffusion range epsilon in the diffusion couples which consisted of a pure nickel side and a two-phase Ni-U alloy side (the Ni matrix being saturated with U and UNi_5 precipitates) was measured from 975 to 1075 C; the solubility of U in Ni was found to be between 0.7 and 1.4 wt % or between 0.18 and 0.33 at. %. An accuracy of 15% was achieved, which is superior to that obtained by X-ray microanalysis or metallography. NSA

N71-27360# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.

SOLUBILITY AND CORROSION BEHAVIOR OF IRON, STEEL, MOLYBDENUM, NIOBIUM, TANTALUM, VANADIUM, TUNGSTEN, AND CHROMIUM IN MOLTEN LEAD AT HIGH TEMPERATURES [LOESLICHKEIT UND KORROSIONSVERHALTEN VON EISEN, STAHL, MOLYBDAEN, NIOB, TANTAL, VANADIUM, WOLFRAM UND CHROM IN BLEISCHMELZEN BEI HOEHEREN TEMPERATUREN]

I. Ali Kaan May 1970 62 p refs In GERMAN
(JUL-661-RW) Avail: AEC Depository Libraries

The samples were investigated metallographically with respect to their corrosion behavior. In general, they show higher corrosion attack at the places at which they were placed under tension. In an Armco iron sample which was in contact with lead for 520 hrs at a temperature of 950 C, intercrystalline corrosion was established. The X 8 CrTi 18 and X 8 CrNb 17 steels were corroded by the lead melt at 650 C during a period of 1000 hrs in the same manner. In both steels the penetration depth was about 38 micrometers. The high-melting metals, such as Mo, Nb, Ta, V, and W, show no solubility in liquid lead up to about 1000 C. The metallographic study showed that V was corroded by lead at 950 C. At 1110 C it was deeply corroded even after only 20 hrs. In Ta fissures occur at 925 C after 324 hrs in the bent part of the sample. At a temperature of 985 C Cr was strongly corroded by lead during a research period of 233 hrs. Author (NSA)

N71-27398# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ESTIMATING THE CHARACTERISTICS OF STRESS RUPTURE STRENGTH

V. V. Krivenyuk et al 15 Dec. 1970 7 p Transl. into ENGLISH from Tekhnol. Organ. Proizvod. (Ukr. SSR), no. 6, 1969 p 102
(AD-720947; FTD-HT-23-832-70) Avail: NTIS CSCL 11/6

The temperature-time dependence of the long-term durability, based on the direct utilization of functions reflecting the peculiarities of specific material, is suggested. Author (GRA)

N71-27403# State Univ. of New York, Stony Brook.

SLIP INITIATION AND MICRODYNAMICS OF FLOW IN TUNGSTEN AND OTHER METALS Progress Report, 1 Jan.–31 Dec. 1970

J. C. Bilello 1970 21 p refs
(Contract AT(30-1)-4073)
(NYO-4073-4) Avail: NTIS

An experimental apparatus for measuring microstrain-stress data as well as determining the continuous time derivatives of the stress and strain was completed. This facility has an ultimate strain-sensitivity of approximately 10 to the −7th power and is capable of operating over a temperature range of 4.2 to 575 K. Work is in progress to extend this system to the compressional mode. Preliminary etch-pit analysis of tungsten revealed that slip initiation in the microregion was inhomogeneous and that source exhaustion models of microyielding were inadequate. Correlation of direct observation of primary and forest dislocation structures with the microstrain behavior of pure Cu and Cu-1% Si single crystals has given insight into the mechanisms of slip initiation in these materials. Author (NSA)

N71-27406# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

STUDY OF ACICULAR PRECIPITATES IN IRRADIATED AUSTENITIC STEELS USING ELECTRON MICROSCOPY [ETUDE AU MICROSCOPE ELECTRONIQUE DE PRECIPITES ACICULAIRES DANS LES ACIERS AUSTENITIQUES IRRADIES]

Andre Bisson and Michel Vouillon 1970 12 p refs In FRENCH
Presented at the Intern. Meeting on Fast Reactor Fuel and Fuel Elements, Karlsruhe, West Ger., 28–30 Sep. 1970
(CEA-CONF-1638; CONF-700920-1) Avail: AEC Depository Libraries

Neutron irradiation of austenitic steel Type 316 at temperatures between 450 and 550 C gives rise to small precipitates in the (110) crystal planes. They are very thin long plates whose maximum dimension is in the (100) direction. They are about 50 A thick. The nature of these precipitates remains indeterminate but their instability indicates that they are not M23C6-type carbides. The precipitates constitute preferential cavity sites. Author (NSA)

N71-27427 Carnegie-Mellon Univ., Pittsburgh, Pa.

THE RATE OF ANODIC POLARIZATION OF IRON AND IRON ALLOYS

Alvin Tirman (Ph.D. Thesis) 1969 117 p
Avail: Univ. Microfilms Order No. 70-12435

Anodic polarization measurements were made on Armco iron, on binary alloys of Fe-Ni, Fe-Mn and Fe-Gr, and on multiple component iron alloys RY, 4140 and 4340. The experimental behavior of the iron overvoltage as a function of current was found to obey empirical equations which, in turn, modified the Tafel equation. The resistance to stress-corrosion cracking of AISI 4340 steel foil in 0.6 molar aqueous sodium chloride, acidified to pH 1.5 with hydrochloric acid, is greatly decreased by prior treatment of the specimens for short periods of time with aqueous and nonaqueous solutions of sulphur, organic and inorganic sulphides, sulphur dioxides and the inorganic salts of sulphurous and sulphuric acids. It is suggested that this prior treatment produces sulphided areas which are inhibitors of the combination of atomic hydrogen into molecular hydrogen. Polyhydroxy derivatives of anthraquinone adsorbed in AISI 4340 steel foil increase the resistance of the foil to stress corrosion cracking. Dissert. Abstr.

N71-27449# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

FRACTURE BEHAVIOR OF 1/4 INCH THICK 7075-T651 A1 CONTAINING SEMIELLIPTICAL SURFACE FLAWS

R. M. Bonesteel 26 Jan. 1971 37 p refs
(AD-720392; Rept-6-83-71-1) Avail: NTIS CSCL 11/6

The static fracture behavior of surface-flawed and of center-through-crack specimens of 1/4-in.-thick 7075-T651 aluminum plate was investigated. The response of surface-flawed specimens to sustained tensile loading while exposed to aqueous 3-1/2% NaCl solution was also studied. An equation was developed that yielded a constant value of fracture toughness for the surface-flawed specimens over a wide range of a/t and a/c ratios. Grain boundary delaminations ahead of the periphery were observed following exposure of specimens to the stress-salt water environment. The size of the delamination zone was found to increase with increasing applied stress intensity; the time of exposure was found to be of secondary importance in establishing the size of the delamination zone. Fracturing the specimens in air following exposure to the stress-salt water environment indicated that the delamination process sufficiently blunted the flaws that in all cases except one the calculated fracture toughness increased as a result of the environmental exposure. Author (GRA)

N71-27487# North Carolina State Univ., Raleigh.

AN ANALYSIS OF PLANE SHOCK STRUCTURES IN 6061-T6 ALUMINUM Technical Report, 1 Sep. 1967 – 31 Aug. 1973

H. L. Chang and Y. Horie Feb. 1971 33 p refs Sponsored in Part by ARPA
(Contract N00014-68-A-0187; Proj. Dynamic Material Response)
(AD-720716; TR-71-1) Avail: NTIS CSCL 11/6

The steady profile of plane shocks in 6061-T6 aluminum by Johnson and Barker is compared with the unsteady ones

obtained by a finite difference integration of dynamic Lagrangian equations. The results purport the conclusions similar to theirs but are not conclusive as they claim. The computed profiles at the distance of 0.6 approximately 1.0 cm from the impact plane are quite close to those of steady profiles in the sigma – epsilon plane, but they seem to be sensitive to the last stretch of the convergence. Also, it is found that strain rate functions proposed by Johnson and Barker are double-valued at high stresses and need to be further clarified in the future. Since the shock structures are based on the elastic-plastic behaviors of Al, extremely sharp elastic spikes are observed in a domain close to the impact plane. Author (GRA)

N71-27482# Germantown Labs., Inc., Philadelphia, Pa.
COMPRESSIBILITY OF LIQUID METALS, PARTICULARLY LEAD, FROM THEIR MELTING POINTS TO THEIR CRITICAL REGIONS
A. V. Grosse Nov. 1970 34 p refs
(Contract AT(30-1)-4176)
(NYO-4176-4; GL-1970-14) Avail: NTIS

Isothermal and adiabatic compressibility properties of liquid metals are discussed. The discussion includes properties of the metals along the saturation line and a comparison of the metals with liquid noble gases. The metals were measured only in the regions of their melting points. E.H.W.

N71-27483 Missouri Univ., Rolla.
X-RAY DETERMINATION OF LATTICE PARAMETERS AND THERMAL EXPANSION COEFFICIENTS OF ALUMINUM, SILVER AND MOLYBDENUM AT CRYOGENIC TEMPERATURES
Claude Lowell Woodard (Ph.D. Thesis) 1969 142 p
Avail: Univ. Microfilms Order No. 70-11768

A multiple exposure back reflection diffraction camera was designed to mount on the vacuum jacket of a pressurized helium gas Cryomite. With this design it is possible to obtain six diffraction exposures on a single film at any temperature in the range of 180 to 25 K. Different specimen mounting methods did not influence a detectable change in the lattice parameters on a 99.99+% silver sample with a particle size of 5 to 25 micron. The lattice parameters of aluminum determined by X-ray diffraction in the temperature range of 40 to 120 K were lower than those calculated from interferometric expansion coefficients. However, lattice parameters of silver obtained by X-ray diffraction were higher in the temperature range of 40 to 180 K. Molybdenum lattice parameters determined by interferometric and X-ray diffraction methods agree well in the temperature range of 100 to 180 K, while lattice parameters calculated from interferometric methods below 100 K are lower than those determined by X-ray diffraction.
Dissert. Abstr.

N71-27618# Virginia Polytechnic Inst., Blacksburg. Dept. of Engineering Mechanics.
UTILIZATION OF HOLLOW NOTCHED ROUNDS IN FRACTURE TOUGHNESS EVALUATION
R. P. McNitt, W. F. Thompson, and S. O. Sawyer, III Mar. 1971 31 p refs Presented at 1970 SESA Fall Meeting, Boston, Oct. 1970
(Contract DAAF07-69-C-0444; Proj. Themis)
(AD-720217; VPI-E-71-2) Avail: NTIS CSCL 11/6

Results of an experimental program to determine fracture toughness data utilizing small notched round tensile specimens are presented. Hydrogen embrittlement was utilized as a crack starter for several solid A1S1 4340 steel specimens. The fractured areas were examined to differentiate the slow crack growth due to hydrogen and the final rapid catastrophic fracture. Hollow notched round specimens of A1S1 4340 steel, Aluminum 7075-T651 and gun steel 4330 were tested to failure for various outside diameter, notch root radius and internal hole size. The resulting apparent fracture toughness values are compared to known values obtained from precracked specimens. Author (GRA)

N71-27629# Aluminum Co. of America, New Kensington, Pa. Alcoa Research Labs.
STRESS CORROSION AND CORROSION FATIGUE SUSCEPTIBILITY OF HIGH STRENGTH ALUMINUM ALLOYS Final Report, Jun. 1967 – Nov. 1970
G. E. Nordmark, B. W. Lifka, M. S. Hunter, and J. G. Kaufman Nov. 1970 139 p refs
(Contract F33615-67-C-1922)
(AD-720857; AFML-TR-70-259) Avail: NTIS CSCL 11/6

The stress-corrosion-fatigue performance of several high strength-aluminum alloys was investigated by tests of hydraulic cylinders and other types of specimens. Specimens were prepared from forgings and forging stock of alloys 2014-T6, 7075-T6, 7075-T73, 7079-T6, and X7080-T7 and from premium castings of alloy CH70-T7. Alloy 7075-T73 rated best in the corrosion-fatigue tests; no stress-corrosion cracking occurred in this alloy, and the lives of forged cylinders subjected to repeated loadings to 80% of design stress in a corrosive environment were at least 10 times as long for this alloy as for forged cylinders of alloys 2014-T6, 7075-T6, or 7079-T6. Fractographic examination showed that stress-corrosion cracking as well as fatigue cracking occurred in alloys 2014-T6, 7075-T6, and 7079-T6 in the stress-corrosion-fatigue tests. The investigation demonstrated that stress corrosion and fatigue can interact under certain conditions to produce failures in shorter times and fewer cycles than for either phenomenon occurring by itself. Author (GRA)

N71-27630*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VAPORIZATION OF THE GROUP 4B METAL CARBIDES
Carl A. Stearns and Fred J. Kohl [1971] 12 p refs Presented at 19th Ann. Conf. on Mass Spectrometry and Allied Topics, Atlanta, 2–7 May 1971; sponsored by Am. Soc. of Mass Spectrometry and Am. Soc. for Testing and Mater. Comm. E-14
(NASA-TM-X-67844) Avail: NTIS CSCL 11F

The high temperature vaporization of the metal-carbon systems Ti-C, Zr-C, Hf-C, and Th-C was studied by the Knudsen effusion-mass spectrometric method. For each system the metal dicarbide and tetracarbide molecular species were identified in the gas phase. Ion intensities of the carbides and metals were measured as a function of temperature. Second- and third-law methods were used to determine enthalpies for the reactions M(g) + 2C(s) = MC2(g) and M(g) + 4C(s) = MC4(g). Experimentally determined reaction enthalpies were combined with published thermodynamic data to obtain dissociation energies. Thermodynamic functions used in the calculations are discussed in terms of assumed molecular structures and electronic contributions to the partition functions. The trends shown by the dissociation energies of the carbides of Group IVB are compared to neighboring groups and discussed in relation to the corresponding oxides and chemical bonding. Author

N71-27682# Iowa State Univ. of Science and Technology, Ames.
EFFECT OF PRECIPITATION ON THE MECHANICAL PROPERTIES OF THE Cu-1.9 PERCENT Co AND THE Cu-2 PERCENT Co-6 PERCENT Zn SYSTEMS
Norman James Olson (Ph.D. Thesis – Nov. 1970) Feb. 1971 123 p refs
(Contract W-7405-eng-82)
(IS-T-422) Avail: NTIS

A theory based on the creation of new surface when glide dislocations cut through coherent, spherical, precipitate particles was developed to explain the flow stress required for cutting as a function of particle size and volume fraction of precipitate. The theory was used in conjunction with the Orowan mechanism to

describe the phenomenon of over aging in aged hardened alloys using statistical methods. The precipitate surface energies found, which correspond to a (111) surface, were approximately 202-242 ergs/sq cm and 161-170 ergs/sq cm for Cu-1.9% Co at 300 and 77 K, respectively; while those for the Cu-2% Co-6% Zn system were 239-249 ergs/sq cm and 161-177 ergs/sq cm at 300 and 77 K, respectively. It was established that the surface energies for the two alloy systems investigated were similar and increased with temperature. An analytical method was established to determine the critical particle size from yield stress data. Author

N71-27677# National Aerospace Lab., Amsterdam (Netherlands).
ELECTRON FRACTOGRAPHY OF FATIGUE IN A HIGH STRENGTH STEEL
D. Broek and W. J. van der Vet Mar. 1969 35 p refs Sponsored by Roy. Neth. Air Force
(NLR-TR-69043-U) Avail: NTIS

An extensive electron fractographical investigation was carried out as a result of a series of fatigue failures in a 4340 type steel. Low tempering temperatures and low stresses promote intergranular fatigue fractures. High stresses and high tempering temperatures promote the formation of striations. Author

N71-27748# Dayton Univ. Research Inst., Ohio.
AN INVESTIGATION OF STRESS CORROSION CRACK ARREST AND CRACK PROPAGATION IN A TITANIUM ALLOY Final Report, May 1969 –Jan. 1970
Gerald J. Petrac Wright-Patterson AFB, Ohio AFML Oct. 1970 29 p refs
(Contract F33615-69-C-1471)
(AD-720235; UDRI-TR-70-26; AFML-TR-70-244) Avail: NTIS CSCL 11/6

It was previously demonstrated that the controlling crack growth criterion in stress corrosion cracking is that derived from fracture mechanics concepts and not a criterion based on gross or net stress. This demonstration was accomplished by testing two types of cracked specimens and showing that crack arrest and crack initiation stress intensities are the same while gross and net stresses are different. However, these tests were performed on thick section material. The work now reported was intended to check the validity of the correlation between arrest and initiation stress intensities using thin section material having higher thoughness and lower yield strength than the material previously tested. The results showed crack arrest stress intensities were substantially higher than those for crack initiation when testing thin materials. It was also observed from the test results that when testing titanium materials testing must be accomplished as soon as possible after fatigue cracking to eliminate any possible effects of crack blunting. Author (GRA)

N71-27750# Atomic Energy Board, Pretoria (South Africa). Physical Metallurgy Div.
THE OXIDATION OF ZIRCONIUM ALLOY IN LIQUID SODIUM AT DIFFERENT OXYGEN LEVELS
D. D. Slatter Jun. 1970 19 p refs
(PEL-201) Avail: AEC Depository Libraries

Results of an investigation of corrosion at different sodium oxide levels are presented. The experimental work was carried out in a sodium tank from which a small stream of sodium could be circulated through a cold trap to adjust the oxide level. The latter was established by periodically withdrawing samples and analyzing them by a vacuum distillation technique. Specimens of zirconium and 3Z1 were exposed to the sodium in the tank for 4 to 400 hours at oxygen levels of 30 and 100 ppM. The results were evaluated by weight change measurements, macroscopic and microscopic examination, X-ray diffraction and electron microprobe analysis. A special polishing technique had to be developed for the metallographic specimens. The 3Z1 specimens were found to form thick, dark oxide layers which progressively became less adherent with increase in corrosion time. This effect was less severe for sodium containing 30 ppM oxygen. Attempts to correlate oxide growth localities with the phase structure of the parent metal were unsuccessful. Author (NSA)

N71-27753# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
ROLE OF COMPOSITION IN METALLIC GLASS FORMATION Interim Technical Report
C. H. Bennett, D. E. Polk, and D. Turnbull Feb. 1971 17 p refs Supported in part by Xerox Corp. fellowship
(Contract N00014-67-A-0298-0009)
(AD-720342; TR-32) Avail: NTIS CSCL 11/6

The paper surveys some ideas on the glass forming tendency of monatomic systems. According to the free volume model, glass formation in such systems would result primarily from jamming due to the action of repulsive forces. From this viewpoint the metals most prone to glass formation should be those in which the repulsive part of the pair potential is, relatively, the largest; these are the noble, transition and polyvalent metals. Actually the most stable metal glasses formed so far are alloys of noble or transition metals (A) with compositions predominantly in the range A3B to A5B where B is a metalloid. The A elements may form a skeleton having a Bernal dense random packed structure which may be somewhat stabilized by filling its holes with metalloid atoms in the manner suggested by Polk. Some additional ideas on the effect of alloying on metal glass forming tendency are discussed. Author (GRA)

N71-27760# Scientific Research Atomic Reactor Inst., Melekess (USSR).
EFFECT OF IRRADIATION OF THE MECHANICAL PROPERTIES OF fcc ALLOYS OF THE Fe-Cr-Ni SYSTEM, PART 1 [VLIYANIE OBLUCHENIYA NA MEKHANICHESKIE SVOISTVA GTSK SPLAVOV SISTEMY FE-CR-NI, I CHAST]
V. D. Balashov, S. N. Votinov, and V. I. Prokhorov 1970 40 p refs In RUSSIAN
(SPARI-P-78) Avail: AEC Depository Libraries

The results of mechanical tests of Fe-Cr-Ni system alloys (X2OH15, X2OH40, X2OH60, X2OH80, and nickel) unirradiated and irradiated in water at 70 C with the dose of 7×10 to the 21st power n/sq cm are presented. It is shown that the effect of high temperature irradiation embrittlement was typical for all the investigated materials and decreased from low nickel alloys to unalloyed nickel. The deformation mechanisms of the irradiated and unirradiated alloys were related. Author (NSA)

N71-27802# Scientific Translation Service, Ann Arbor, Mich.
MARTENSITIC TRANSFORMATIONS IN LOW-CARBON AUSTENITIC CHROME-NICKEL STEELS
Hermann Schumann and Hans-Jochen von Fircks [1971] 19 p refs Transl. into ENGLISH from Arch. Eisenhuettenw. (Dusseldorf), v. 40, 1969 p 561–568 Sponsored by AEC Prepared for Oak Ridge National Lab.
(ORNL-tr-2423) Avail: NTIS

Dilatometric, radiographic, metallographic, and magnetic examinations are made on the phase transformation in low carbon chromium-nickel steels. The examinations were made at temperatures of down to −196 C in 19 steels containing 0.05% C, 7.3 to 22.4% Cr, and 2.6 to 17.9% Ni. A martensitic transformation diagram was established dependent on the (Cr + Ni) content with a triple point. Metallographic discernment gamma, epsilon, and alpha in the microstructure and in the surface relief are also examined. Comparisons are made of the martensitic transformation chart of the chromium-nickel steels with that of the manganese steels. The origin of the epsilon phase is discussed. Author

N71-27928# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.
SOME OBSERVATIONS ON THE STRUCTURE AND TENSILE PROPERTIES OF AISI TYPE 316 STEEL AS A FUNCTION OF FAST REACTOR IRRADIATION TEMPERATURE
P. J. Barton Jun. 1970 14 p refs
(AERE-R-6435) Avail: AEC Depository Libraries

Solution treated AISI Type 316 steel strip specimens were irradiated in the Dounreay Fast Reactor to doses of 1.0 to 1.3 × 10 to the 22nd power n/cm (total), 1.7 to 2.6 × 10 to the 21st power n/cm (fission) within the following measured temperature ranges: 420 to 440, 500 to 513, 520 to 533, 560 to 570, and 645 to 650 C. Transmission electron microscopy revealed the presence of voids after irradiation at all these temperatures. Distribution was uniform after irradiation at 420 to 440, 500 to 513, and 520 to 533 C. At higher temperatures it was uneven and concentration was so low that probably helium bubbles and not voids were being observed. From the temperature dependence of void concentration and average diameter it is deduced that the consequent density decrease is maximal after irradiation at 500 to 513 C. Dislocation loops were present for irradiation at all but the highest temperature. At 420 to 440 C all loops were faulted. As irradiation temperature increased, loop concentration decreased. Yield stress increases estimated from loop and void concentrations are found to be in fair agreement with measured values. Author (NSA)

N71-27968# Atomic Weapons Research Establishment, Aldermaston (England).
INFLUENCE OF IMPURITIES ON THE PROPERTIES OF URANIUM
R. J. Wakelin Sep. 1970 41 p refs
(AWRE-O-63/70) Avail: AEC Depository Libraries; HMSO 7s; BIS$1.40

The effects of Fe, Si, Al, Ni, Cr, and Zr impurities on the properties of uranium were investigated. The difficulties of making uniform and reliable U–C alloys is now appreciated. The main practical result of use in U-235 processing is that the iron content must be limited to 500 ppM maximum, the silicon and aluminum contents to 1000 ppM each. The effect of up to 2000 ppM of any of these impurities did not seriously affect the drawing characteristics. Author (NSA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N71-26813# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IMPROVING THE QUALITIES OF THE ALKYLPHENOL ADDITIVE BFK
A. M. Kuliev et al 22 Dec. 1970 10 p Transl. into ENGLISH from Prisadki k Smazochnym Maslam (USSR), no. 2, 1969 p 3–7
(AD-720927; FTD-HT-23-767-70) Avail: NTIS CSCL 11/8

The additive BFK produced from alkylphenol subjected to preliminary purification by silica gel, aluminum silicate catalysts, and distillation under vacuum has a higher level of purity and is preferable to BFK produced in the usual manner with respect to anticorrosion and neutralizing properties. The quality of the additive produced from purified alkylphenol is comparable to the quality of non-Soviet additives. Author (GRA)

N71-26815# National Inst. for Research in Nuclear Science, Chilton (England). Rutherford High Energy Lab.
POST IRRADIATION MECHANICAL PROPERTIES OF EPOXY RESIN/GLASS COMPOSITES
D. Evans, J. T. Sheldon, and G. B. Stapleton Jun. 1970 19 p refs
(RHEL/R-200) Avail: AEC Depository Libraries; HMSO 3s-6d; BIS$.70

Fourteen epoxy resin systems were examined. The data indicated that a significant advantage can be gained in the radiation stability of epoxy composites by the use of tri- or tetra-functional glycidylamines, which can withstand doses of 10 to the 10th power R without change in physical properties. These resins, in combination with liquid methyl nadic anhydride, have a low viscosity and a long room temperature pot life and are therefore useful impregnating materials in magnet coil fabrication. NSA

N71-26821# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
MATERIALS DAMPING OF GLASS FIBER EPOXY AND BORON FIBER ALUMINUM COMPOSITES Final Report
Marion G. Pottinger Oct. 1970 26 p refs
(AD-721191; ARL-70-0237) Avail: NTIS CSCL 11/4

In the report, measurements of the material damping, loss tangent, of glass fiber-reinforced epoxy and boron fiber-reinforced aluminum are reported and compared with the literature where a comparison is possible. The data we taken from the decay of longitudinal resonance oscillations of small amplitude. Measurements were taken at frequencies up to 150KHz. The maximum damping is at around 10 KHz for both materials. The data indicates that a secondary damping maximum may occur at frequencies at or about 100 KHz in Boron reinforced aluminum. Author (GRA)

N71-26915*# Lockheed Missiles and Space Co., Palo Alto, Calif.
STUDY AND PRODUCTION OF POLYBENZIMIDAZOLE BILLETS, LAMINATES, AND CYLINDERS
Burton S. Marks, Lester E. Shoff, and Gazel W. Watsey Washington NASA May 1971 151 p refs
(Contract NAS2-5521)
(NASA-CR-1723) Avail: NTIS CSCL 11D

Polybenzimidazole (PBI) syntactic foam composites and polybenzimidazole-carbon cloth laminates were produced for evaluation as ablative thermal protection systems for the proposed Space Shuttle vehicle and Planetary Probes, respectively. Processes were developed for producing these composites with consistent properties. The foam composites have densities of 0.4 to 0.5 gm/cu cm, have low thermal conductivity, are nonflammable, nonsmoking, have low weight loss to 600 C and retain their high mechanical properties to 350 C. These PBI foam composites could also find applications as thermal and fire barriers and as cryogenic insulation. The PBI-carbon cloth laminates have a density of 1.4 gm/cu cm and possess high mechanical properties. Processes are described for producing billets and cylinders of the foam composites and laminates of the PBI-carbon cloth. Physical, chemical and thermal tests were performed to characterize these composite systems. Author

N71-26922# Aberdeen Research and Development Center, Aberdeen Proving Ground, Md. Coating and Chemical Lab.
IMPROVED FINAL RINSE FOR ZINC PHOSPHATE PRETREATMENT COATINGS
William H. Deaver Mar. 1971 26 p refs
(AD-721283; CCL-290) Avail: NTIS CSCL 11/3

In an effort to increase corrosion resistance of TT-C-490, Type 1, zinc phosphate pretreatments, a study was conducted on inhibitors added to the final rinse. Salt spray testing and tropical exposure studies indicated that a final rinse containing sodium chromate produced an increase in underfilm corrosion resistance with one coat paint systems. Author (GRA)

N71-26923# California Univ., Livermore. Lawrence Radiation Lab.
THEORY IDENTIFICATION FOR MECHANICAL BEHAVIOR OF POLYSTYRENE BEAD FOAMS
G. Latter, R. Dong, and W. St. Lawrence 13 Oct. 1970 18 p ref Sponsored in part by AEC
(UCRL-50952) Avail: NTIS

A series of tension-compression tests with variable test rates and temperatures was conducted on SD 505 polystyrene bead foam of 0.05 and 0.1 g/cu cm. The test technique and specimens are described. The applicability of the data for design use is discussed. Author (NSA)

N71-26933# Sandia Corp., Albuquerque, N.Mex.
STOCHASTIC ANALYSIS OF FRACTURED GLASS
A. F. Veneruso and R. H. Brassch Dec. 1970 46 p refs
(SC-RR-69-506) Avail: NTIS

An analytical technique and a measurement method for data gathering are developed for obtaining the probability density function of the surface area remaining on particles procured from the residue of fractured chemically strengthened glass elements. To demonstrate the general application of developed method, experimental and computational results are given. Author

N71-26949# Sandia Corp. Albuquerque, N.Mex. Ceramics and Surface Physics Div.
FRACTURE BRANCHING AND DICING IN STRESSED GLASS
E. K. Beauchamp Jan. 1971 26 p refs Sponsored by AF and AEC
(SC-RR-70-766) Avail: NTIS

A model is presented for the initiation of branching fractures which are responsible for dicing of stressed glass and glass-ceramics. Initiation is explained in terms of deviation of a segment of the primary fracture front, isolation of that segment through retardation of the contiguous regions, and growth of the resultant tongue in the stress field of the primary. Optical and electron micrographs are presented in support of this model. Author (NSA)

N71-26967# Liege Univ. (Belgium). Lab. d'Essais des Constructions du Genie Civil et d'Hydraulique Fluviale.
RELATIONSHIP BETWEEN THE POLYMERIZATION STATE, FATIGUE, AND CREEP OF GLASS FIBER REINFORCED EPOXY RESINS [RELATION ENTRE L'ETAT DE POLYMERISATION, LA FATIGUE ET LE FLUAGE D'UNE RESINE EPOXY REINFORCEE AU VERRE TEXTILE]
Georges Chiron (Soc. du Verre Textile), Kazimierz Gamski, and Georges Viatour (Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal.) Brussels Centre de Rech. Sci. et Tech. de L'Ind. des Fabric. Metal. Jan. 1971 39 p refs In FRENCH Sponsored by IRSIA
(CRIF-PL-1) Copyright. Avail: NTIS

Tests have been carried out on glass cloth reinforced stratified epoxy resin plates to determine polymerization effects on their fatigue and creep strengths. The test procedure is described and results are tabulated. ESRO

N71-26968# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
MAGNESIUM FLUORIDE: PHYSICAL PROPERTIES AND DEFECTS INDUCED BY IRRADIATION [LE FLUORURE DE MAGNESIUM: PROPRIETES PHYSIQUES ET DEFAUTS INDUITS PAR IRRADIATION]
M. Romero Dec. 1970 67 p refs In FRENCH
(ONERA-DERTS-NT-02-21-70) Avail: NTIS

A survey is presented of the physical, electrical, and optical properties of magnesium fluoride. Results are tabulated and presented as graphs. Nonidentified absorption bands are found and the stability of several M centers discussed. ESRO

N71-26986# California Univ., Berkeley. Lawrence Radiation Lab. Inorganic Materials Research Div.
THE CHARACTERIZATION OF THE MATRIX OF BRITTLE MATRIX COMPOSITES
James Frederick Holzgraf (M.S. Thesis) Dec. 1970 19 p refs
(Contract W-7405-eng-48)
(UCRL-20388) Avail: NTIS

A soda borosilicate glass was prepared in four different ways to vary its water content. Uniaxial bend strengths of the glasses and of brittle matrix composites prepared from the glasses are reported as a function of water concentration. Abraded and as-sawn glass and composite strengths decreased with decreasing water content. The effect of the water on the glass structure and abrasion characteristics is discussed in relation to the strength. Author

N71-26987# California Univ., Berkeley. Lawrence Radiation Lab. Inorganic Materials Research Div.
STRENGTH OF INTERNALLY STRAINED BRITTLE MATRIX COMPOSITES
Christian A. Young (M.S. Thesis) Dec. 1970 20 p refs
(Contract W-7405-eng-48)
(UCRL-20395) Avail: NTIS

The effect of internal stresses on the strength of chemically bonded composites was investigated. Spherical Al2O3 powder was dispersed in soda-borosilicate glasses of varying coefficients of thermal expansion. Uniaxial strengths were measured on the vacuum hot-pressed glasses and composites. The strengths of the composites were approximately all the same, even when there was a large difference in thermal expansion between the dispersed and matrix phases. Therefore, it is concluded that internal stresses do not affect the strength of well bonded, brittle-matrix composites. Author

N71-27008*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A STATE-OF-THE-ART LITERATURE SURVEY OF THORIA-DISPERSED NiCr FOR THE SPACE SHUTTLE THERMAL PROTECTION SYSTEMS
W. L. Hayes 4 Mar. 1971 52 p refs
(NASA-TM-X-64802) Avail: NTIS CSCL 11D

A literature survey is presented on the status of technology for processing and fabricating thoria-dispersed nickel chrome (TD NiCr), a candidate material for space shuttle thermal protection systems. The literature indicates that TD NiCr possesses the high-temperature strength (up to 1477 K) and other desirable characteristics. Author

N71-27013# Bendix Corp., Kansas City, Mo. Dept. 845.
CONFORMAL COATING Quarterly Report No. 4, 1970
W. F. Moyle Dec. 1970 15 p
(Contract AT(29-1)-613)
(BDX-613-265; PDO-6984462; FY70-4) Avail: NTIS

Continued work on expansion of coating-thickness measurement capability included preliminary evaluation of three additional Microdac probes and review of several prospective methods of providing coatings of appropriate thicknesses for full evaluation of each probe. Work during this period indicated that each probe size is suitable for measuring a specific range of coating thicknesses. However, a defective probe and nonavailability of samples with sufficient coating thicknesses prevented a full evaluation. Author

N71-27014# Bendix Corp., Kansas City, Mo.
CONFORMAL COATING Quarterly Report No. 3, 1970
W. F. Moyle Dec. 1970 15 p

(Contract AT(29-1)-613)
(BDX-613-257; PDO-6984462; FY-70-3) Avail: NTIS

A commercially available microwave system is being evaluated as a possible nondestructive means of measuring thicknesses of conformal coatings. Preliminary evaluation established a method of calibrating the meter indications in relation to coating thicknesses. Two probes supplied with the equipment indicated the method workable for the specific samples. Author

N71-27038# Advisory Group for Aerospace Research and Development, Paris (France).
THE CHARACTERIZATION AND APPLICATION OF MATERIALS
May 1971 151 p refs
(AGARD-LS-51-71) Avail: NTIS

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7. CHARACTERIZATION, SELECTION AND USE OF TITANIUM BASE ALLOYS R. Syre (SOCIETE TREFIMET-AUX, ARGENTEUIL, FRANCE) 46 p refs (See N71-27045 15-17)

N71-27039# Pennsylvania Univ., Philadelphia. School of Metallurgy and Materials Science.
A SYSTEMS APPROACH TO THE SELECTION AND APPLICATION OF MATERIALS
Robert Maddin *In* AGARD The Characterization and Appl. of Mater. May 1971 20 p refs (See N71-27038 15-18)
Avail: NTIS

Analyses undertaken by a materials engineer in a materials system concept consist of: market applications, shape of required parts, environmental effects on exposed part, material properties in relation to environment, and selection of materials and feasible manufacturing processes. Characterization of a material includes precise descriptions of its chemical composition, impurities, and factors associated with grain and substructures. G.G.

N71-27041# California Univ., Berkeley. Lawrence Radiation Lab. Inorganic Materials Research Div.
NATURE, STATUS, AND SELECTION OF CERAMIC MATERIALS
Joseph A. Pask *In* AGARD The Characterization and Appl. of Mater. May 1971 66 p Sponsored by AEC (See N71-27038 15-18)
Avail: NTIS

Ceramic materials are identified as having ionic-covalent bonding, being composed of compounds, and being either crystalline or glassy. The oxides are of particular interest because of their chemical stability up to high temperatures. Brittle behavior makes them sensitive to flaws either intrinsic or extrinsic, thus requiring a uniform distribution of uniform flaws to achieve reliability. Intrinsic flaws can be correlated with character features. Extrinsic flaws in themselves are character features. Both of these features can be correlated with mechanical properties and behavior. A number of applications of ceramic materials based on their unique properties of chemical resistance, high strength/density rations, high modulus of elasticity/density ratios, hardness, optical transparency, and electrical resistance are revised. Author

N71-27042# Ecole d'Application des Hauts Polymeres, Strasbourg (France).
CHARACTERIZATION, SELECTION, AND USE OF POLYMERIC MATERIALS [PROPRIETES, SELECTION ET APPLICATIONS DES POLYMERES]
C. Wippler *In* AGARD The Characterization and Appl. of Mater. May 1971 14 p In FRENCH; ENGLISH summary (See N71-27038 15-18)
Avail: NTIS

Polymeric substances are classified as either thermosetting or thermoplastic resins. The first category includes phenolic resins, urea and melamin formaldehyde resins, epoxy resins, unsaturated polyesters, and elastomers. These are polymeric substances, the synthesis of which is achieved during the processing by the curing phase. The second category includes polyvinyl resins: polythylen, polyvinyl chloride, polystyrene. Their state essentially depends on temperature and time scale. Their properties are influenced not only by their chemical nature, but also by their molecular weight and molecular structure. The selection of a polymeric substance for a given application depends on a number of physio-chemical characteristics, thermal characteristics, mechanical characteristics electric or optical characteristics, and on its cost. Author

N71-27043# National Physical Lab., Teddington (England).
FIBRE REINFORCED MATERIALS
A. Kelley *In* AGARD The Characterization and Appl. of Mater. May 1971 12 p (See N71-27038 15-18)
Avail: NTIS

A new range of materials which are made of strong, stiff fibers embedded in a matrix which may be resin, metal, or even glass is considered. Some of the properties of the new strong fibers are listed; their arrangements in a fiber-reinforced body are strikingly similar to that found in natural materials. The present state of knowledge about the principles of fiber reinforcement is reported. A clear distinction is made between a brittle solid which breaks sharply with little and no flow, and a fragile solid which breaks easily. Cracks which usually lead to breaking behave differently in a fragile solid and in a fibrous aggregate, though both are brittle. Author

N71-27112# Sandia Corp., N.Mex.
DETERMINATION OF BORON AND NITROGEN IN BORON NITRIDE
Sanford L. Erickson and Frank J. Conrad Feb. 1971 13 p refs Sponsored by AEC
(SC-RR-71-73) Avail: NTIS

Improved techniques are described for the determination of boron and nitrogen in pure boron nitride. Controlled fusion of boron nitride with sodium carbonate in a muffle furnace is followed by a potentiometric titration of the boric acid. A special quartz vessel is described for the determinstion of nitrogen. The boron nitride is fused with sodium hydroxide and the resulting ammonia is swept into a receiver and titrated with standard hydrochloric acid. Boron and nitrogen values with their standard deviation are given for a typical pure boron nitride. Author

N71-27115# Texas Univ., Austin. Materials Science Lab.
ELEVATED TEMPERATURE MORPHOLOGICAL STABILITY OF METAL MATRIX FIBER COMPOSITES Progress Report
T. H. Courtney Feb. 1971 15 p refs Sponsored by AEC

(ORO-3947-5) Avail: NTIS

Continuing research on the relationship between morphological factors and elevated temperature stability of metal matrix fiber composites is reported. The coarsening behavior at 600 C of Al-Al3Ni eutectic composite specimens grown at 10 cm/hr is described. The morphological stabilities of the eutectic at 600 C and 550 C were determined and are compared. N.E.N.

N71-27131# Washington State Univ., Pullman. Research Div.

POLYMER GRAFTING TO INORGANIC SUBSTRATES Annual Report, 1 Feb. 1969–31 Jan. 1970

R. A. V. Raff, R. V. Subramanian, D. J. Schecter, and M. F. Adams 31 Jan. 1970 93 p refs

(Contract AT(45-1)-2098)

(RLO-2098-1) Avail: NTIS

An exploratory study was made on the effects of gamma radiation on a number of inorganic filler-polymer resin composites. The feasibility of a masterbatch technique to prepare active fillers was explored with polystyrene–carbon black and polyethylene–aluminum oxide systems, and desirable trends were observed in the selective response of certain properties of these systems to gamma irradiation. The potential utility of gamma radiation was further confirmed by the greatly improved mechanical properties of carbon black-reinforced and glass fiber-reinforced polyethylene specimens after exposure to gamma rays. There were no major differences brought about by gamma irradiation in the properties of phenolic resin laminates with carbon or graphite cloth inserts or of glass fiber-reinforced polyester resin. Gamma irradiation was applied successfully in other areas. Author (NSA)

N71-27170* North American Rockwell Corp., Downey, Calif.

DYE PENETRANT FOR SURFACES SUBSEQUENTLY CONTACTED BY LIQUID OXYGEN Patent

Ralph M. F. Giles and Isidore Pollack, inventors (to NASA) Issued 2 Mar. 1971 6 p Filed 3 Feb. 1965 Cl. 252-301.2; Int. Cl. C09k1/02; Int. Cl. G01n21/16, 21/38 Sponsored by NASA

(NASA-Case-XMF-02221; US-Patent-3,567,651; US-Patent-Appl-SN-430192) Avail: US Patent Office CSCL 11C

A dye penetrant inspection material and technique are described for nondestructive testing of solid surfaces that may be contacted by liquid oxygen. The dye penetrant solution comprises a trifluorchloroethylene polymer having a degree of polymerization in the range of from 2 to 10 in a quantity sufficient to suppress violent reaction of the solution with liquid oxygen. The solution also has a halogenated solvent with an evaporation rate not greater than the evaporation rate of methylene chloride and miscible with the polymer, plus a dye soluble in the polymer and the solvent. The quality of the dye is not greater than 1:20 relative to the polymer so that the solution is substantially insensitive to the reaction of strongly oxidizing materials.

Official Gazette of the U.S. Patent Office

N71-27219# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorbauelemente.

OBSERVATION WINDOWS OF SYNTHETIC SAPPHIRE (LEUCOSAPPHIRE) IN HIGH PRESSURE VESSELS [BEOBACHTUNGSFENSTER AUS SYNTHETISCHEM SAPHIR (LEUKOSAPHIR) IN HOCHDRUCKGEFAESSEN]

H. Schmidt Sept. 1970 88 p refs In GERMAN; ENGLISH summary

(KFK-1211) Avail: AEC Depository Libraries

High-speed photographs are required for a study of the phenomena of direct material and heat exchange during the dispersion of a gas in a liquid so that the geometric events can be followed. Investigations of this type are performed in the water-steam system at operating pressures up to some 200 atm. The sight glasses in this case are panes of synthetic sapphire (leucosapphire). Experiments have shown that some panes do not stand up to the stress despite good resistance to pressure, temperature, and the attacking medium, the rupture behavior observed varying over a rather wide range of pressures. The characteristics of colorless corundum are described. For a given geometric setup the rupture behavior of the sapphire is discussed. A new disk geometry is suggested and its testing is reported. The forces occurring during bursting are calculated for a given design. The choice of a suitable safety device and its experimental testing are reported. Author (NSA)

N71-27289# Brown Univ., Providence, R.I. Engineering Materials Research Lab.

CREEP OF POLYURETHANE UNDER VARYING TEMPERATURE FOR NONLINEAR UNIAXIAL STRESS

J. S. Y. Lai (Utah Univ.) and W. N. Findley Feb. 1971 33 p refs

(Contract ARPA SD-86)

(AD-720334; EMRL-44; ARPA-E-76) Avail: NTIS CSCL 11/9

Two methods are described to account for varying temperature during creep. Both employ the modified superposition principle. One uses a reduced time involving a shift factor which is a function of both stress and temperature history. The other considers the strain to be a function of the current values of stress and temperature. Experiments on polyurethane include constant stress creep and recovery at several temperatures in the nonlinear range and an experiment in which the stress was held constant while the temperature increased at a constant rate, then the stress was removed and the temperature decreased at a constant rate. The strain in this experiment was predicted by means of the theories from the results of the constant temperature creep tests. The strains in the constant temperature creep and recovery tests were described by means of the multiple integral representation and the modified superposition principle. Most of the nonlinearity and temperature effect were found in the coefficient of the time-dependent term. Author (GRA)

N71-27338# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

USE OF THE ADDITIVE INKhP-46 TO IMPROVE THE OPERATIONAL PROPERTIES OF LUBRICATING OILS FOR REDUCTION GEARS WITH NOVIKOV GEARING

F. G. Suleimanova et al 22 Dec. 1970 10 p Transl. into ENGLISH from Prisadki k Smazochnym Maslam (USSR), no. 2, 1969 p 131–135

(AD-721031) Avail: NTIS CSCL 11/8

The use of the additive INKhP-46, containing sulfur, chlorine, and phosphorus, provides improvement of the functional properties of lubricating oils used in reduction gears with Novikov gearing. Tests showed that during operation of reduction gears of deep pumping units with Novikov gearing at an overload of 1.6 times the use of oil industrial-45 with 3 percent INKhP-46 provides an increase in the time to beginning of pit formation and also facilitates smaller changes in the physicochemical properties of the oil during prolonged operation in the reduction gears. Author (GRA)

N71-27346# Bhabha Atomic Research Centre, Bombay (India) Spectroscopy Div.

SPECTROGRAPHIC DETERMINATION OF RUTHENIUM IN SILICEOUS MATERIALS USED IN RADIOACTIVE WASTE DISPOSAL: AN ac SPARK METHOD

P. Sreerama Murphy and M. J. Kamat 1970 7 p ref

(BARC-504) Avail: AEC Depository Libraries

A spectrographic method is described to determine ruthenium in siliceous materials coated with iron oxide, using ac spark excitation. Two 5 mg portions of the sample are deposited on two flat top 1/4 in. diam graphite electrodes (U.C.C. type 107) and sparked for 40 seconds. The spectra are photographed on an Ebert 3.4 m plane grating spectrograph using a 30,000 lines per inch grating in the first order in the region 3500 to 4125 A. The

concentration range of Ru covered is 0.1 to 5.0%. Palladium is used as the internal standard element. The coefficient of variation of the method is 8%. Author (NSA)

N71-27373# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY OF THE STRUCTURAL CHANGES IN MINERAL OIL ADDITIVES BY INFRARED SPECTROSCOPY
A. B. Vipper et al 2 Dec. 1970 10 p refs Transl. into ENGLISH from Neftepererab. Neftekhim. Akad. Nauk Ukr. SSR, Respub. Mezhvedom. Sb. (USSR), no. 9, 1969 p 23–25
(AD-721030; FTD-MT-24-285-70) Avail: NTIS CSCL 11/8

Under wearability of motor oil additives we understand their diminution from oil and the loss of effectiveness as a result of decomposition, interaction with products of fuel combustion and the oxidation of oil, with filtering elements and other engine parts which come in contact with oil. The authors examine the wearability of additives in a narrower sense - the structural changes which lead to a decrease in content in the oil of the separate functional groups of additives. Mixtures of DS-11 oil with additives were studied before and after testing them on a PZV device according to a rigid procedure. The results of these tests (lacquer formation on the piston, the quantity and composition of oxidation products in the oil, and others) are given. The results of an analysis obtained by infrared spectroscopy and which attest to the structural changes in the molecules of the additives during oxidation of mineral oil in the PZV device are given. The structural elements of the additives were judged by IR-spectra obtained relative to the air, and also by the differential spectra partially described. Author (GRA)

N71-27397* Lockheed Missile and Space Co., Sunnyvale, Calif.
APPARATUS FOR DETECTING THE AMOUNT OF MATERIAL IN A RESONANT CAVITY CONTAINER Patent
Jack C. Miller, inventor (to NASA) Issued 9 Mar. 1971 6 p Filed 16 Nov. 1965 Cl. 324-58.5; Cl. 324-61; Int. Cl. G01r27/04
Sponsored by NASA
(NASA-Case-XNP-02500; US-Patent-3,569,827; US-Patent-Appl-SN-508169) Avail: US Patent Office CSCL 09C

The mass of a dielectric material contained in an internal cavity of a metallic container, and therefrom the quantity of material, is determined by connecting the container as the positive feedback impedance of an amplifier. Losses are supplied to enable the arrangement to oscillate at the frequency of resonance of the container. This frequency varies with the mass of dielectric material in the container. Accordingly, from the resonant frequency the amount of material present is determined.

N71-27399# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF THE ANTIFRICTION PROPERTIES OF SOLID LUBRICANTS
L. M. Gulko et al 16 Dec. 1970 6 p Transl. into ENGLISH from Tekhnol. Organ. Proizvod. (Ukr. SSR), no. 6, 1969 p 95
(AD-720948; FTD-HT-23-833-70) Avail: NTIS CSCL 11/8

The problems in application of solid lubricants with lamellar structure are discussed. Author (GRA)

N71-27400# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNTHESIS OF BIS-(GAMMA-ARYLOXY-BETA-CHLOROPROPYL) SULFIDES AND DISULFIDES AND STUDY OF THEIR USE AS ANTIWEAR AND ANTISEIZING ADDITIVES FOR OILS
A. M. Kuliyev et al 22 Dec. 1970 9 p refs Transl. into ENGLISH from Prisadki Smaz. Maslam (USSR), no. 2, 1969 p 52–56
(AD-720943; FTD-HT-23-766-70) Avail: NTIS CSCL 7/3

The authors synthesized 8 new bis-(gamma-aryloxy-beta-chloropropyl) sulfides and disulfides, not previously described in the literature, by reacting sulfur chlorides with allyleryl esters. They established that the obtained sulfides and disulfides posses good antiwear and anticorrosion properties. Author (GRA)

N71-27401# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNTHESIS AND STUDY OF DIALKYLBENZYL DISULFIDES
A. M. Kuliyev et al 22 Dec. 1970 7 p refs Transl. into ENGLISH from Prisadki Smaz. Maslam (USSR), no. 2, 1969 p 27–29
(AD-720942; FTD-HT-23-765-70) Avail: NTIS CSCL 7/1

Results from testing certain of the synthesized disulfides on a 4-ball friction machine using mark ShKh-15 balls indicated that they possess high antiwear properties. Thus when the dialkylbenzyl sulfide obtained from chloromethylated catalytic cracking naphtha was added to oil AK-15 in a quantity of 5 percent, the generalized wear index of the oil was raised to 65.5. Analogous results were obtained when other representatives of the dialkylbenzyl disulfides were introduced into the composition of oil AK-15. Thus, the series of catalytic cracking fractions can be used as cheap and available raw materials for the synthesis of highly effective antiwear oil additives. Author (GRA)

N71-27421# Sandia Corp., Albuquerque, N.Mex. Nondestructive Testing Div.
ULTRASONIC CHARACTERIZATION AND COMPUTERIZED ANALYSIS OF GRAPHITE BILLETS
R. A. Baker, D. E. Bishop, and G. C. Stoker Dec. 1970 62 p refs
(SC-DR-70-693) Avail: NTIS

A computer-aided, ultrasonic test system for graphite billets was developed, the primary purpose of which was to select the optimum location within the billet of a reentry vehicle nose tip. An on-line mini-computer provides process control functions and initial data processing. Visualization of the internal structure is aided by the use of computer-controlled plotter. The ultrasonic test system consists of a commercial ultrasonic tester with an automatic scanning and immersion system. A special interface module receives ultrasonic test data from the tester and converts this information to analog voltages, while an auxiliary function module, controlled by the mini-computer, digitizes and records the position and ultrasonic information on magnetic tape. A large computer analyzes the ultrasonic flaw data in terms of up to 3300 possible nose tip locations within the billet. In evaluating each particular nose tip location, every flaw indication is assigned a weight. The 15 positions having the lowest weights are presented to the design engineer for his final selection. Author (NSA)

N71-27426# Battelle-Northwest, Richland, Wash.
PROPERTIES OF MOLTEN CERAMICS
J. L. Bates, C. E. McNeilly, and J. J. Rasmussen 1970 18 p refs Presented at Conf. on Ceramics in Severe Environments, Raleigh, N.C. Sponsored by AEC
(BNWL-SA-3579; CONF-701206-1) Avail: NTIS

Techniques were developed for measuring the volume change on melting, density, melting point, expansivity, surface tension, viscosity, adiabatic compressibility, and thermal diffusivity of molten ceramic materials to 3000 C. Many of these techniques are extensions of general methods used to measure liquids at lower temperatures, with modifications to reflect the severe conditions imposed by the high temperatures. Several of these techniques used to study molten ceramics are described. The associated experimental difficulties and representative results are also presented. Because of space limitations, no attempt was made to present comprehensive review of the potential high temperature, experimental methods or an analysis of the results. NSA

N71-27620# Aeronautical Research Labs., Melbourne (Australia).
THE HIGH TEMPERATURE COMPATABILITY OF BORON AND CARBON FIBRES WITH CHROMIUM
E. J. Lumley Nov. 1970 17 p refs
(ARL/Met-83) Avail: NTIS

An examination was made of the interfacial reactions of boron fibers and carbon fibers in chromium matrices at elevated temperatures. Composite fiber-metal test pieces made by enclosing the fibers in a heavy electrodeposit of chromium were heated in argon or in vacuum at temperatures between 600 C and 1200 C for times of up to 75 hours for the B–Cr composites and up to 4 hours for the C–Cr samples. Interaction commenced at about 600 C in each system and severe degradation of the fibers occurred at higher temperatures. The C–Cr interaction consisted mainly of solid state diffusion at temperatures between 600 C and 900 C, but carbides formed above this temperature. The B–Cr composites reacted chemically at lower temperatures, borides forming at about 700 C. Void formation and porosity occurred in the interaction products due mainly to shrinkage resulting from the lower specific volumes of the borides and carbides. Interfacial interactions were assessed metallographically, by electron microprobe analysis and by scanning electron microscopy. The tests indicated the unsuitability of unprotected boron and carbon fibers as materials for the fiber reinforcement of chromium or its alloys for high temperature applications. Author

N71-27636*# Southern Research Inst., Birmingham, Ala.
PROPERTIES OF ABLATION AND INSULATION MATERIALS. VOLUME 3: THERMAL AND MECHANICAL PROPERTIES OF LOW-DENSITY PHENOLIC-NYLON AND SILICONE-PHENOLIC ABLATORS
E. D. Smyly, W. F. Swoger, and C. D. Pears Jun. 1971 321 p
(Contract NAS1-7732-1)
(NASA-CR-111909) Avail: NTIS HC $8.00/MF $0.95 CSCL 11B

The thermal properties were measured on virgin materials including a low-density silicone-phenolic (MG-1), a low-density silicone-phenolic in a phenolic-glass honeycomb (MG-45), and a low-density phenolic-nylon in a phenolic-glass honeycomb (MG-58) from 150 K to 500 K. The properties measured included thermal conductivity, enthalpy (heat capacity), thermal expansion, permeability, bulk density, true density, pore size, and volume fraction measurements. For the chars of the honeycombed materials (MG-45 and MG-58), which were prepared in an arc-jet, thermal conductivity, enthalpy, bulk density, true density, pore size, and volume fraction measurements were made. For the chars of the silicone-phenolic (MG-1), which were prepared in a laboratory furnace, thermal conductivity, enthalpy, permeability, emittance, bulk density, true density, pore size, and volume fraction measurements were made. Thermal conductivity and enthalpy measurements on the chars were made to 3000 K and 2000 K respecitvely, for the MG-45 and MG-58 and to about 1500 K for the MG-1. Author

N71-27676*# United Aircraft Corp., East Hartford, Conn. Research Labs.
DETERMINING AND ANALYZING THE STRENGTH AND IMPACT OF HIGH MODULUS GLASS
James F. Bacon 15 May 1971 18 p refs
(Contract NASw-2209)
(NASA-CR-118882; K911105-1; QSR-1) Avail: NTIS CSCL 11B

An experimental glass, UARL 417, was prepared in large quantity as a monifilament and used to form a number of glass fiber-epoxy resin test specimens. The composite samples made contained 65% glass fiber and were used to measure flexural strength, flexural modulus, bending stress-strain curve, short beam shear strength, tensile strength, tensile modulus, and tensile stress/strain curve. For several of these properties the UARL 417 glass fiber-epoxy resin composites gave results as high or higher than the experimental fiber PRD-49-I incorporated in a similar resin. UARL 344 glass fiber-epoxy resin composites also gave superior results for several properties. Author

N71-27699# Battelle-Memorial Inst., Columbus, Ohio.
ELECTROSTATIC METHODS TO CONTROL PLACEMENT AND ORIENTATION OF SHORT GRAPHITE FIBERS Final Report
R. B. Reif, L. R. Albrechtson, J. H. Walder, M. C. Brockway, F. P. Kirkhart et al Jan. 1971 50 p Prepared for Sandia Corp., Albuquerque, N.Mex.
(SC-CR-69-3277) Avail: NTIS

Several electrostatic methods were evaluated for classifying graphite fibers according to size and length. Dedusting or removal of fiber whiskers produced during carbonization of the fibers was accomplished with both static and alternating fields between nonparallel plates. Separation of fiber fragments, 10-mil fibers, and oversize fibers was demonstrated in the alternating field device. A number of electrostatic techniques were examined for producing oriented and isotropic structures with graphite fibers and fiber-particulate composites. The fibers were charged by induction or ion bombardment and then deposited in either an oriented or unoriented manner in an electrical field. Because the conductive fibers reversed charge inductively when deposited on a metallic surface, heavy deposits could not be made unless an adhesive or an insulating substrate such as tympan paper was used to collect the material. The same technique was used successfully to prepare fiber composites with feed compositions of 5, 10, 15, and 25 percent Thermax carbon and other carbon particles. Addition of the carbon particles improved the deposition rate and density of the fiber structures. Author

N71-27748*# Southern Research Inst., Birmingham, Ala.
PROPERTIES OF ABLATION AND INSULATION MATERIALS. VOLUME 1: THERMAL PROPERTIES OF SOME FILLED AND FOAMED LOW DENSITY ABLATORS
E. D. Smyly and C. D. Pears Jun. 1971 82 p refs
(Contract NAS1-7732-1)
(NASA-CR-111912) Avail: NTIS CSCL 11D

Thermal conductivity, thermal expansion, and heat capacity were determined on a virgin, low-density, silicone elastomer and a virgin, filled cork, from 150 K to 500 K. Thermal conductivity and heat capacity were determined on a virgin, high density, silicone phenolic and a virgin, blown (foamed), silicone-elastomer with a carbon black filler in a phenolic-glass honeycomb at about 300 K. Author

N71-27755# Battelle Memorial Inst., Columbus, Ohio.
THIN FILM RHEOLOGY OF BOUNDARY LUBRICATING SURFACE FILMS, PART 1 Final Report, 20 Oct. 1969–20 Oct. 1970
E. Drauglis, C. M. Allen, W. H. Jones, Jr., N. F. Hartman, J. M. Genco et al Dec. 1970 50 p refs
(Contract N00019-70-C-0139)
(AD-721176) Avail: NTIS CSCL 11/8

The objectives of the work are to obtain a more quantitative understanding of the behavior and properties of liquid films on solid substrates and to apply this understanding to the formulation of better lubricants. A qualitative model based on the formation of a chemisorbed film and a resulting ordering of solvent and additive molecules was found to fit almost all of the experimental data. In the most highly ordered case, the model predicts layered structures. Quantitative calculations of the interaction energy between two layers were performed and the results agreed well with experiment and other published theory of monolayer lubrication. The experimental work in the program consisted of measurements of film thickness and attempts to determine degree of ordering by nuclear magnetic resonance measurements. Capacitance measurements of film thickness of hydrocarbon-stearic acid films confirmed the theory by

demonstrating the necessity of both a reactive substrate and fatty acid additive for the formation of a film. Films some 2000 A thick were obtained from a 0.1 weight percent stearic acid in benzene solution. By means of capacitance measurements, it was also found that a nonadditive synthetic diester gas turbine lubricant did not form a stable film whereas the same fluid with an antiwear additive forms a stable film some 700 A thick. Similar results were obtained with a synthetic paraffin base lubricant. Author (GRA)

N71-27768# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DEPENDENCE OF THE VISCOSITY OF POLYTETRAFLUOROETHYLENE ON TEMPERATURE

A. Ya. Samoilova 11 Dec. 1970 8 p refs Transl. into ENGLISH from Tr. Vses. Nauchn. Konf., 4th, 1965: Reliksatsionnyye Yavleniya v Tverd. Telakh (USSR), 1968 p 569–571
(AD-721025; FTD-HT-23-716-70) Avail: NTIS CSCL 7/4

From the plots of given temps in 0.2-1.0 Hz range the relaxation activation energies (H) were obtained for Ftoroplast-4 (Polytetrafluoroethylene) (I) and K-21-22 (Phenol-formaldehyde, resin. filled with food flour) (II). For I,H equals 6.5 kcal/mole; and for II, samples of different crystallinities H ranged from 3.2 to 9.9 kcal/mole, supporting the view (D. D. Chegodaev, 1960) that 1 polymer molecule may extend over amorphous and crystal regions. The energy of group vibrations around C-C bonds in I ranged from 3.6 to 5.3 kcal/mole, while the energy of intermol. attraction in I was 2 kcal/mole. Author (GRA)

N71-27783*# Manlabs, Inc., Cambridge, Mass. Materials Research and Development.

INVESTIGATION OF THE FRACTURE MECHANICS OF BORIDE COMPOSITES Quarterly Report No. 3

Larry Kaufman Jun. 1971 19 p refs
(Contract NASw-2088)
(NASA-CR-118866) Avail: NTIS CSCL 11D

Approximately fifty measurements of the energy required to fracture notched bars of boride composites and cobalt bonded tungsten carbide were carried out. The results of these tests are given in tabular form. These data provide a description of the fracture energies of current boride composites and allow a direct comparison to be made with cobalt bonded tungsten carbide. Author

N71-27977# California Univ., Berkeley. Lawrence Radiation Lab.

FACTORS INFLUENCING THE STRESS-STRAIN BEHAVIOR OF CERAMIC MATERIALS

Terence Langdon and Joseph A. Pask Dec. 1970 32 p refs Presented at Conf. on Ceramics in Severe Environments, Raleigh, N.C., 7 Dec. 1970
(Contract W-7405-eng-48)
(UCRL-20383; CONF-701206-2) Avail: NTIS

The factors influencing the stress-strain behavior of single crystals are briefly reviewed. It is shown that the results obtained under a given set of experimental conditions depend on features ranging from crystal orientation, which is readily determined, to less controllable parameters such as the presence, and in particular the state of dispersion, of certain impurities. An examination of experimental results obtained on several different types of polycrystalline MgO suggests that ductility is aided at temperatures less than 1200 C by the presence of strong grain boundaries and by fine intragranular porosity. Author

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N71-28016*# Grumman Aerospace Corp., Bethpage, N.Y.

AN ALGORITHM FOR LIAPUNOV STABILITY ANALYSIS OF COMPLES NONLINEAR SYSTEMS WITH APPLICATION TO THE ORBITING ASTRONOMICAL OBSERVATORY

Gunther R. Geiss, Victor D. Cohen, Robert D'heedene, D. Rothschild, and Arthur Chomas Washington NASA May 1971 180 p refs
(Contract NAS2-4063)
(NASA-CR-1729) Avail: NTIS CSCL 12A

The development of an algorithm for estimating the domain of attraction of equilibrium of a paired tracker coarse attitude control mode is described for the Orbiting Astronomical Observatory. The algorithm generates an optimal quadratic Liapunov function by formulating the domain estimate as a min-max problem solved by random search techniques. The importance of the choice of state variables for the model is emphasized. Testing the algorithm on the full nine-dimensional model and a six-dimensional approximation gave comparable results. Though the estimated domain of attraction is small in comparison with direct stimulation, the region extends well beyond inception of the dominant saturating nonlinearity. Author

N71-28024# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

EXACT JOINT DISTRIBUTIONS OF FEW ROOTS OF A CLASS OF RANDOM MATRICES Final Report

P. R. Krishnaiah and V. B. Waikar Dec. 1970 22 p refs
(AD-721190; ARL-70-0345) Avail: NTIS CSCL 12/1

In this paper, the authors derived the exact expression for the joint marginal density of any few consecutive ordered roots of a class of random matrices. In addition, the authors obtained an expression for the probability integral associated with the joint distribution of any two ordered roots. The class of random matrices considered includes Wishart matrix, multivariate analysis of variance matrix and canonical correlation matrix. The authors also obtained an expression for the joint density of any two unordered roots of the above class of random matrices. Some of these results are useful in reduction of dimensionality in pattern recognition problems, and the statistical analysis of energy levels of certain complicated systems in physics. Author (GRA)

N71-28030*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EQUIVALENT MEASUREMENTS, OBSERVABILITY, AND CALIBRATION ACCURACY LIMITS IN LINEAR ESTIMATION

Luigi S. Cicolani Washington May 1971 85 p refs
(NASA-TN-D-6388; A-3442) Avail: NTIS CSCL 12A

The structure of the linear estimation problem is investigated. First, data compression, performance analysis, and information separation are examined in the case of processing arbitrary sets of measurements. Second, the measurements are limited to samplings of given data types so that properties of the data types are common to any sampling. Thus, the unknowns to be estimated can be reduced to those observable to the data types. Finally, estimation is intended to compare an unknown system to internationally defined physical units. Measurements separate into comparisons with physical units (calibrations) and comparisons among unknowns. Generally, measurements are of the second type and their processing compares the unknown system to intermediate physical standards which appear as unobservable parameters that limit the achievable estimation accuracy. Author

N71-28034# Sandia Corp., Albuquerque, N.Mex. Numerical Fluid Dynamics Div.

DIRECT METHOD FOR THE DISCRETIZED POISSON EQUATION

Patrick J. Roache Feb. 1971 47 p refs
(SC-RR-70-579) Avail: NTIS

The error vector propagation method for solving the discretized

Poisson equation is described. The method is applicable to irregular geometries, and is 1 to 2 orders of magnitude faster than popular iterative methods for representative problems. Author

N71-26978*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DETERMINATION OF STATISTICS FOR ANY ROTATION OF AXES OF A BIVARIATE NORMAL ELLIPTICAL DISTRIBUTION
Lee W. Falls and Harold L. Crutcher 11 May 1971 9 p refs
(NASA-TM-X-64595) Avail: NTIS CSCL 12A

A method is presented for the determination of the estimates of means, variances, covariances, and correlations for any rotation of axes of a bivariate normal elliptical distribution. This problem arises in connection with vehicle launches at Cape Kennedy, Florida, when winds normal and parallel to the vehicle flight path are launch constraints. A vector wind data sample is resolved into wind components in a rectangular coordinate system, and the bivariate normal elliptical distribution theory is applied to the data sample of component winds. However, theoretical inferences are required for any arbitrary firing azimuth of the launch vehicle. This requires a rotation of axes of the bivariate normal surface and the computation of new statistics after rotation. Author

N71-27033# National Physical Lab., Teddington (England). Div. of Electrical Science.
SOME PROPERTIES OF FUNCTIONS ON THE NON-NEGATIVE INTEGERS LESS THAN 2 TO THE nth POWER. CHAPTER 1
J. E. Gibbs Dec. 1969 26 p
(NPL-DES-3) Copyright. Avail: NTIS

The discrete logical derivatives of discrete functions relating to integers as can be represented in a computer by binary digit words are derived. The solution of the discrete Walsh-Paley logical differential equation is discussed and the properties of the discrete Walsh-Paley functions are outlined. ESRO

N71-27217# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
SOME NOTES ON AN APPROXIMATE SOLUTION FOR THE FREE OSCILLATION CHARACTERISTICS OF NON-LINEAR SYSTEMS TYPIFIED BY $x''+F(x,x')=0$
L. J. Beecham and I. M. Titchener London Aeron. Res. Council 1971 30 p refs Supersedes RAE-TR-69172; ARC-31710
(ARC-R/M-3651; RAE-TR-69172; ARC-31710) Copyright. Avail: NTIS; HMSO: 80p; BIS: $3.20

An approximate method is derived and applied to particular cases with a large frequency dependence on amplitude. It provides an approximate solution of the frequency and the amplitude damping envelope in terms of the amplitude, and suggests itself as a means of cataloging, in matrix form, the characteristics of practical nonlinear systems. Author (ESRO)

N71-27256# California Univ., Los Angeles. Dept. of System Sciences.
GLOBAL INVERSE AND IMPLICIT FUNCTION THEOREMS VIA ORDINARY DIFFERENTIAL EQUATIONS
John M. Fitts Mar. 1971 33 p refs Prepared in cooperation with Hughes Aircraft Co., Culver City, Calif.
(Grant AF-AFOSR-1328-67)
(AD-720894; AFOSR-TR-71-0632) Avail: NTIS CSCL 12/1

A lemma on the existence and uniqueness of certain ordinary differential equations is shown to be equivalent to a class of global inverse and implicit function theorems. A theorem is also developed on the existence and uniqueness of solutions to a set of nonlinear equations. Author (GRA)

N71-27396# Rice Univ., Houston, Tex. Aero-Astronautics Group.
NOTE ON A PROBLEM BY LANCE AND A PROBLEM BY BELLMAN
K. H. Well 1971 25 p refs
(Grant AF-AFOSR-828-67)
(AD-721210; AAR-83; AFOSR-71-0782TR) Avail: NTIS CSCL 12/1

In this paper, the method of particular solutions developed in a paper by Miele (1968) for linear systems and in a paper by Miele and Iyer (1970) for nonlinear systems is employed to solve two difficult two-point boundary-value problems. One is the nonlinear problem of Lance and Rogers and the other is the linear problem of Bellman and Kalaba. In both cases, the method of particular solutions yields the solution without difficulty. Author (GRA)

N71-27433 California Univ., Los Angeles.
GROUP GEOMETRY AND EFFECTIVE LAGRANGIANS GENERATED BY A MASSIVE GAUGE FIELD
Lawrence Patrick Staunton (Ph.D. Thesis) 1969 174 p refs
Avail: Univ. Microfilms Order No. 70-12020

The massive Yang-Mills gauge field is shown to be the Lagrangian equivalent of a composite massless field containing pseudoscalars as well as vector components which are minimally coupled to each other. In general, the total boson field consists of both vectors and pseudoscalars, but there exists a privileged gauge in which the pseudoscalars are transformed away. An SU(3) X SU(3) effective Lagrangian, generated by the massive gauge field is formulated with the aid of the group geometrical method and the complete currents are presented. These parameters are determined by a fitting of the linearized theory to the pion - nucleon system. Results for other members of the octets include a determination of the D/F ratio, the pseudoscalar - baryon coupling constants, which depend in a fundamental way on the masses of the vector meson multiplet, the kaon leptonic decay constant, and a simplified derivation of the Callen - Treiman formula. Dissert. Abstr.

N71-27619# Aeronautical Research Labs., Melbourne (Australia).
MATRIX EIGENVALUE CALCULATION BY THE DANILEVSKI METHOD
N. B. Joyce and Betty Emslie Apr. 1970 23 p refs
(ARL/SM-349) Avail: NTIS

Danilevski's method for determination of the eigenvalues of a matrix with real elements has been programmed in FORTRAN. The method yields a complete set of eigenvalues and vectors. The program has the ability of factorizing the characteristic polynomial. Although this ensures that values are obtained for all roots, it can introduce errors. Estimates for these errors are given, together with indications of the overall accuracy of the program. Author

N71-27632*# Bellcomm, Inc., Washington, D.C.
CHARACTERIZATION AND MATHEMATICAL REPRESENTATION OF LINE SCANNING IMAGE SYSTEMS
S. Y. Lee 25 May 1971 25 p refs
(Contract NASw-417)
(NASA-CR-118893; TM-71-1031-2) Avail: NTIS CSCL 12A

By the use of basic techniques which were developed for treating linear filters in network theory, models and the mathematical relationships of scanning are derived. To overcome the limitations of the one-dimensional and two-dimensional Fourier integral analyses of the line scanning system, a semidiscrete method of analysis is developed. This method is used to evaluate more precisely the system performance when the output signal is inherently discrete and when post filtering is performed. Author

N71-27723*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
IDENTIFICATION OF SITUATIONS WHERE COOPERATION IS PREFERABLE TO USE OF MEDIAN GAME THEORY
John E. Walsh 13 Jan. 1970 12 p refs Sponsored in part

by Mobile Res. and Develop. Corp.
(Grant NGR-44-007-028; Contract N00014-68-A-0515; Proj. Themis)
(NASA-CR-118884; TR-54) Avail: NTIS CSCL 12A

Situations are identified where cooperation is definitely preferred. Two types of cooperation are considered. One is where no side payments are made. This type of cooperation can occur for any situation where median game theory is applicable. Side payments can be made for the other type of cooperation. This type can occur for the situations where all payoffs can be expressed in a common unit. A rule is given for deciding when cooperation is advantageous for both types of cooperation. Some implications of this rule are discussed. Author

N71-27724*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
GENERALLY APPLICABLE SOLUTIONS FOR TWO PERSON MEDIAN GAME THEORY
John E. Walsh 18 Dec. 1969 9 p refs Sponsored in part by Mobil Res. and Develop Corp.
(Grant NGR-44-007-028; Contract N00014-68-A-0515; Proj. Themis)
(NASA-CR-118885; TR-51) Avail: NTIS CSCL 12A

The advantages of a two person game theory over expected value game theory are discussed. In the large class of median games there is at least one player who does not have an optimum solution. That is, for one player or both players, no strategy exists such that the player can simultaneously be as protective as possible for himself and as vindictive as possible toward the other player. To reasonably resolve such situations a relative desirability function, suitably chosen, is used to order pairs of payoffs, a payoff to each player, that occur for some of the combinations of pure strategies (according to increasing desirability to the player considered). This provides the basis for a compromise optimum solution and identification of a corresponding optimum strategy. Author

N71-27725*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
GREATLY INCREASED PRACTICAL USEFULNESS OF TWO PERSON GAME THEORY BY ADOPTION OF MEDIAN CRITERION
John E. Walsh and Grace J. Kelleher 1 Apr. 1970 15 p refs Sponsored in part by Mobil Res. and Develop. Corp.
(Grant NGR-44-007-028; Contract N00014-68-A-0515; Proj. Themis)
(NASA-CR-118887; TR-62) Avail: NTIS CSCL 12A

The discrete two person game theory where the players choose their own strategies is discussed. Two approaches to the median game theory are outlined and compared to the minimax game theory. The comparisons are made with respect to generality of application and effort needed for application (at the end of each line). The two approaches are then compared to each other. Author

N71-27726*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
MEDIAN TWO PERSON GAME THEORY AND EXAMPLES OF ITS FLEXIBILITY IN APPLICATIONS
John E. Walsh and Grace J. Kelleher 1 Apr. 1970 13 p refs Sponsored in part by Mobil Res. and Develop. Corp.
(Grant NGR-44-007-028; Contract N00014-68-A-0515; Proj. Themis)
(NASA-CR-118886; TR-61) Avail: NTIS CSCL 12A

An introduction to median-game theory is provided and the generally applicable solution, which depends on choices of relative desirability functions by the two players, is given. The flexibility of the theory is illustrated through considerations in the selection of relative desirability functions. Examples are included. Author

N71-27727*# Southern Medotist Univ., Dallas, Tex. Dept. of Statistics.
ROBUST VARIABLES CONTROL CHARTS BASED ON SAMPLE MEANS
John E. Walsh and Grace J. Kelleher 12 May 1969 12 p refs Sponsored in part by Mobil Res. and Develop. Corp.
(Grant NGR-44-007-028; Contract N00014-68-A-0515; Proj. Themis)
(NASA-CR-118888; TR-33) Avail: NTIS CSCL 12A

The in-control probability properties of a class of variables control charts for continuous data situations are discussed. In these situations the customary assumption of sample values from a normal population can be strongly violated. The control charts considered are for surviellance of the population mean. Some operating characteristic values and efficiencies are computed for the cases of normality and r = 2, 3 with subsamples. E.H.W.

N71-27728*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
DESCRIPTION OF MEDIAN GAME THEORY WITH EXAMPLES OF COMPETITIVE AND MEDIAN COMPETITIVE GAMES
John E. Walsh and Grace J. Kelleher 1 Apr. 1970 21 p refs
(Grant NGR-44-007-028; Contract N00014-68-A-0515; Proj. Themis)
(NASA-CR-118890; TR-63) Avail: NTIS CSCL 12A

An introduction to median game theory and examples of competitive, one player median competitive for one player, and median competitive games are given. Author

N71-27729*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
A NEW APPROACH TO TWO PERSON GAME THEORY USING MEDIAN CONSIDERATIONS
John E. Walsh and Grace J. Kelleher 13 Mar. 1970 19 p refs Sponsored in part by Mobil Res. and Develop. Corp.
(Grant NGR-44-007-028; Contract N00014-68-A-0515; Proj. Themis)
(NASA-CR-118889; TR-58) Avail: NTIS CSCL 12A

The applications and advantages of the median approach over the expected value approach in game theory are discussed. Anticipated extensions and results are outlined. Author

N71-27730*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
DISCRETE TWO PERSON GAME THEORY WITH MEDIAN PAYOFF CRITERION
John E. Walsh 5 Mar. 1969 22 p refs
(Grant NGR-44-007-028; Contracts N00014-68-A-0515; N00014-68-C-0379; Proj. Themis)
(NASA-CR-118891; TR-27) Avail: NTIS CSCL 12A

A form of discrete two person game theory that is based on median value considerations is presented. The median approach and some of its properties are outlined. Some comparisons are made with the standard minimax form of two game theory. Author

N71-27761*# Bellcomm, Inc., Washington, D.C.
COMPUTATIONALLY CONVENIENT FORMS FOR CONIC SECTION EQUATIONS
D. H. Novak 8 Jan. 1971 18 p refs
(Contract NASw-417)
(NASA-CR-118894; B71-01045) Avail: NTIS CSCL 12A

The three dimensional vector forms of selected conic section relationships are described. These relationships are of general interest for application to a wide variety of trajectory mechanics problems; in particular, they have been used in a newly developed n-body trajectory simulation based on the virtual mass concept. The kinematic relationships are derived directly from the basic two body equation of motion in order to stimulate greater appreciation

of the geometric interpretation of the vector orbital elements. A new universal form for time of flight is presented and the simplicity of the recursive computational procedure is detailed. A program is described for solving the Kepler problem in either of two possible modes: an approximate solution in a free running trajectory propagation, or an exact iteration to a precise time for accurate event simulation. Author

N71-27785*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VARIANTS OF THE SECANT METHOD FOR SOLVING NONLINEAR SYSTEMS OF EQUATIONS
Clarence Cantor Jan. 1971 110 p refs
(NASA-TM-X-65453; X-733-71-48) Avail: NTIS CSCL 12A

Some variants of the secant method are developed for solving f(x) = 0, n nonlinear equations in n unknowns. The new methods, consisting of algorithms 1 and 2, depart from existing versions of the secant method whenever certain conditions arise that would tend to cause poor convergence of the latter. These conditions are ascertained via simple test criteria associated with the new algorithms. When these criteria are satisfied initially at each step, the algorithms follow the same steps as existing versions of the secant method and, under certain assumptions, are shown to possess superlinear convergence. Whenever these test criteria are not satisfied initially, the algorithms follow logical alternate procedures that provide a basis for linear convergence. The results of numerical experiments with a series of randomly generated problems support the claim of improved convergence for the new methods. Author

N71-27811*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
GENERALLY APPLICABLE TWO-PERSON PERCENTILE GAME THEORY
John E. Walsh 31 Mar. 1970 23 p refs
(Grant NGR-44-007-028; Contract N00014-68-A-0515; Proj. Themis)
(NASA-CR-118861; THEMIS-SMU-TR-59) Avail: NTIS CSCL 12A

A discrete two-person game theory, where players choose their strategies separately and independently and payoffs can be of a very general nature, is considered. The totality of outcomes (pairs of payoffs), corresponding to the possible combinations of strategies, can be ranked separately by each player according to their desirability to that player. For specified alpha sub i, a largest level of desirability (corresponds to one or more outcomes O sub i) occurs for the i-th player such that he can assure, with probability at least alpha sub i, that an outcome with at least this desirability is obtained; this can be done simultaneously for i = 1,2. Game theory of a median nature occurs when alpha sub 1 = alpha sub 2 = 1/2. A method is given for determining O sub i and an optimum (mixed) strategy for each player. Practical aspects of applying this percentile game theory are examined. Results for alpha sub 1 = alpha sub 2 = 1/2 are compared with those previously developed for discrete median game theory. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N71-26822# Air Force Cambridge Research Labs., Bedford, Mass.
STUDIES OF CLOUDS AND WEATHER OVER SOUTHEAST ASIA
John H. Conover 21 Jan. 1971 47 p refs
(AD-721186; AFCRL-71-0078; AFCRL-AFSIG-229) Avail: NTIS CSCL 4/2

A radar weather index forecast was used to provide a measure of precipitation coverage which in turn would serve as a guide to more detailed forecasts of ceiling, visibility, etc. The index equals the percent coverage by radar echoes within a 50-nmi radius of the station. Hourly indices were computed for Tan Son Nhut, Pleiku, Ubon, and Udorn. From the analysis of cloudiness, winds, and pressure distributions it was found that weather over the three southernmost stations is best related to prior conditions to the east. Activity at the northernmost station also relates to prior conditions to the east, but weak pressure correlations are also found over the Tibetian Highlands and western Indochina, suggesting an influence from the northwest and west. Using a stepwise multiple regression program, equations were developed for forecasting 1,2, and 3 days in advance the probability that the radar index in the afternoon, 1230 to 2330 LT, would be low, average, or high. Variables of cloudiness, sea level pressure, and pressure gradients were found most useful. Nomograms were made to simplify calculations of the forecasts. Author (GRA)

N71-26825# Air Force Cambridge Research Labs., Bedford, Mass.
COMPENSATION OF INTERPOLATION BY LINEAR FILTER
Ralph Shapiro 28 Jan. 1971 24 p refs
(AD-721185; AFCRL-71-0058; AFCRL-PSRP-443) Avail: NTIS CSCL 4/2

A method for counteracting the damping effects of interpolation makes use of simple symmetric linear filters. Specifically for use in numerical integrations involving multiple mappings of a grid network on a sphere, it has been designed to take advantage of the relative simplicity of map representations in numerical integrations and at the same time avoid the instability that is due to incompatible solutions in the overlap region. Whether or not the method will actually succeed in this purpose can only be determined from specific experiments. The method makes use of linear filtering to produce a maximum restoration of damped amplitude, and may therefore also be useful in generating initial grid point data from irregularly spaced station data as part of some general objective analysis procedure. The procedures are general and may find application in such diverse problems as that of incorporating nonsynoptic data into an objective analysis procedure or in limited-area nesting problems. Author (GRA)

N71-26861# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 251 28 Apr. 1968 p 6–11 refs (See N71-26859 15-13)
Avail: NTIS

News briefs concerning meteorology are presented. Included are reports of the results from annihilation of arctic ice, and solar activity effect in the atmosphere. An abstract of an article on the circulation, and vertical movements at the 500-mb level is also included. F.O.S.

N71-26873# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 250 16 Apr. 1971 p 7–9 refs (See N71-26871 15-13)
Avail: NTIS

The regional classification of elementary synoptic processes of eastern Antarctica is examined. It is announced that two new regions in central Asia will receive hail suppression service. Abstracts are also presented on various meteorological literature, including rice yield and agrometeorological conditions and size determination and concentration of inhomogeneities. J.A.M.

N71-26903# Joint Publications Research Service, Washington, D.C.
METEOROLOGY

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 252 14 May 1971 p 5–7 refs (See N71-26901 15-13)
Avail: NTIS

On 17 April 1971 the Soviet Union launched a Meteor meteorological earth satellite. The basic task in the launching of the satellite was to obtain meteorological information required for use in the operational weather service. The satellite was inserted into an orbit with the following parameters: (1) apogee, 646 kilometers; (2) perigee, 620 kilometers; (3) orbital inclination, 81.2 degrees; and (4) initial period, 97.2 minutes. The satellite carried meteorological equipment to obtain pictures of the cloud cover and snow cover on the illuminated and dark sides of the earth as well as data on the thermal energy reflected and radiated by the earth and atmosphere. In addition to the meteorological equipment, the Meteor satellite carried a system for ensuring constant orientation of the satellite on the earth, a power supply system with independent orientation of the solar batteries on the sun, a radio system for precise measurement of the orbital elements, and a radio telemetry system for transmitting data on the operation of instruments and scientific equipment to earth. Author

N71-26912# Naval Weather Service Environmental Detachment, Asheville, N.C.
CLIMATOLOGICAL STUDY, SOUTHERN CALIFORNIA OPERATING AREA
Mar. 1971 249 p
(AD-721117) Avail: NTIS CSCL 4/2

These charts were prepared for the Naval Weather Service Command by the National Climatic Center (NCC), Asheville, N. C. The NCC is operated by the Environmental Data Service (EDS), a component of the U. S. Department of Commerces National Oceanic and Atmospheric Administration (NOAA). Climatological data were based upon tabulations from Tape Decks 1116 and 1128 covering the period 1949-1970, summarized by 1/2 degree latitude-longitude quadrangles. Sea current data were provided by the Naval Oceanographic Office, Washington, D. C. Mixed layer depth and thermocline gradient analyses were based on bathythermograph (BT) tabulations provided by the Environmental Data Services National Oceanographic Data Center (NODC). Thermocline gradients were selected from representative layer summaries at 20 meter intervals. Author (GRA)

N71-26917# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
SYNOPTIC-SCALE WEATHER DISTURBANCES THAT INFLUENCE THE FIRE CLIMATE IN SOUTHEAST ASIA DURING THE NORMALLY DRY PERIOD Final Report
Morris H. McCutchan and Bernadine A. Taylor 1971 78 p refs
(ARPA Order 818)
(AD-721112) Avail: NTIS CSCL 4/2

Fire climate in Southeast Asia is affected by two major factors, rainfall and cloud cover. By fire climate one means the climate that affects the inception and behavior of wildfire. In our study of the fire climate in Southeast Asia we investigated, when, for how long and by what mechanism the normally dry period (November through April) is interrupted by widespread rain and clouds. The author found five types of synoptic-scale weather disturbances usually responsible for extensive rainfall over Southeas Asia during the dry period. Case histories are given of general rain that were caused by these five types of disturbance: (1) 30 November 1962--tropical cyclones and easterly waves; (2) 21-23 March 1963--troughs in the westerlies; (3) 24 and 25 November 1962--superposition of trough in the westerlies on easterly waves; (4) 29 March 1963--surges of the northeast monsoon; and (5) 7-9 March 1963--tropical troughs. Author (GRA)

N71-26971# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Feb. 1971 [OBSERVATIONS CLIMATOLOGIQUES Bulletin Mensuel, Fevrier 1971]
1971 16 p In FRENCH and DUTCH
Avail: NTIS

Meteorological parameters observed at different Belgian weather stations during Februay 1971 are given. ESRO

N71-26972 World Meteorological Organization, Geneva (Switzerland). Joint Organizing Committee for GARP.
REPORT OF PLANNING CONFERENCE ON GARP
Apr. 1970 51 p Conf. held at Brussels, Mar. 1970 *Its* GARP Spec. Rept. No. 1
Copyright. Avail: Issuing Activity

A planning conference on Global Atmospheric Research Program to investigate the relationships between large scale, medium scale, and small scale events in the tropical atmosphere above the Atlantic Ocean is reported. The arrangement of international cooperation and the use of satellites of different origin is discussed. The acquisition of numerical data to enter numerical atmosphere models in view of air pollution problems is mentioned.

N71-26973# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
DIGITAL DATA ACQUISITION AND PROCESSING OF WEATHER RADAR DATA [DIGITALE MESSWERTERFASSUNG UND -VERARBEITUNG VON WETTERRADARDATEN]
Guenter Kuers Oct. 1970 44 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-32) Avail: NTIS; ZLDI Munich: 15.80 DM

A digital data acquisition system is described which, within certain limits, allows radar echoes to be digitized and stored. A computer program (ALGOL) was worked out which provides, besides other possibilities, a presentation of video signal values or precipitation rates in grid print maps. From first grid print maps it can be seen that the new method, compared with the conventional screen photograph, increases the spatial resolution so that it becomes determined only by pulse width of the transmitter and beam width of the antenna of the radar set. It was possible to recognize six intensity levels at best from the screen photograph, but the digital data acquisition system makes it possible to distinguish 1000 levels and print three place values. Author (ESRO)

N71-26974*+ National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A REFERENCE ATMOSPHERE FOR VANDENBERG AIR FORCE BASE, CALIFORNIA, 1971 VERSION
E. A. Carter (Lockheed Missiles and Space Co., Huntsville, Ala.) and S. C. Brown 10 May 1971 67 p refs
(NASA-TM-X-64590) Avail: NTIS CSCL 04B

The reference atmosphere established is based on the most current annual tabulation of thermodynamic quantities for Vandenberg Air Force Base, California. Polynomial coefficients are included for each of the basic thermodynamic parameters of pressure, density, temperature, and virtual temperature. The coefficients define analytical expressions for each of these quantities so that they may be computed at any desired altitude. The coefficients result from a least squares fit of the respective parameters versus geometric altitude from 0 to 81,750 meters. The reference atmosphere is also extended to 700 km altitude by the technique given in the U. S. Standard Atmosphere, 1962, with latitude adjustments so that it is directly applicable to Vandenberg Air Force Base. Computed values of pressure, kinetic temperature, virtual temperature, molecular temperature, density, coefficient of viscosity, kinematic viscosity, speed of sound, molecular weight, pressure ratio, density ratio, viscosity ratio, and pressure difference are tabulated from 0 to 700 km altitude. Author

N71-26976 International Geophysical Year World Data Center A, Washington, D.C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 6, NO. 10, OCTOBER 1969
Asheville, N.C. NOAA Natl. Climatic Center 1971 226 p
Avail: SOD $3.00

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations nearest the time of firing are included. Author

N71-26977 International Geophysical Year World Data Center A, Washington, D.C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 6, NO. 11, NOVEMBER 1969
Asheville, N.C. NOAA Natl. Climatic Center 1971 192 p
Avail: SOD $3.00

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations nearest the time of firing are included. Author

N71-27051# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FFTF SITE SAFETY ANALYSIS: METEOROLOGY AND CLIMATOLOGY
[1971] 16 p Sponsored by AEC
(BNWL-1350) Avail: NTIS

The topography of the site does not include surface features that strongly perturb airflow in the immediate area. Predominant features tend to establish airflow from the north and northwest and from the southwest. Stability classification data indicate that moderately stable or better diffusion conditions will exist over the Hanford Reservation approximately 95% of the time for 0-3 mph wind speeds. The use of moderately stable conditions was judged to be appropriate for the radiological evaluations. Wind velocity data indicate a high variability in direction and velocity. The use of a velocity of one meter/second for radiological calculations appears to be conservative. Data further support the low probability of sustained wind direction. Rainfall in the region of the site is sufficiently low that precipitation scavenging of released material is not considered to be a mechanism for depleting a contaminant cloud. An estimate of the probability of tornado occurrence at the site supports the conclusion that no special design considerations are required for tornado protection. Author

N71-27211# Naval Postgraduate School, Monterey, Calif. Dept. of Meteorology.
A MESOSCALE INVESTIGATION OF CONVECTIVE ACTIVITY
Leo Harvey Craiglow, Jr. (M.S. Thesis) Mar. 1971 190 p refs
(AD-721242) Avail: NTIS CSCL 4/2

A mesoscale investigation of a series of tornadoes and thunderstorms that passed through the NSSL mesonetwork in Oklahoma, on 10 June 1967, between 1700 and 2300 CST, was conducted. Utilizing upper air data provided by NSSL, the divergence, vertical motion, and energy fields were computed. A finite-difference technique for computing and smoothing divergence was developed. The vertical motion was then computed by means of the kinematic method. Both the total derivative and the local rate of change of static energy were computed. Using the values of the local rate of change, prognostic fields of static energy and an energy index were obtained. Finally, forecast energy indexes, divergence, and vertical motion fields were compared to the observed locations of tornadoes and thunderstorms. Author (GRA)

N71-27270# Naval Postgraduate School, Monterey, Calif.
AN ANALYSIS OF JET STREAM STRUCTURE AND ENERGETICS USING AN OBJECTIVE COMPUTATIONAL SCHEME
Robert Frederick Riordan (M.S. Thesis) Mar. 1971 57 p refs
(AD-721221) Avail: NTIS CSCL 4/2

An analysis of jet stream structure and energetics is performed using an objective scheme that calculates wind components normal and parallel to the jet axis, with provisions to explicitly calculate the eddy components of variables. Most of the meteorological data used is generated by a diagnostic-balanced, omega-equation model. Results indicate that above 500 mb observed winds and temperatures should be used versus computer generated data. There is some indication that between the jet entrance and exit regions the mean transverse vertical circulation reverses from thermally direct to thermally indirect. Kinetic energy is imported from below the jet into the jet stream region primarily by the mean pressure interaction at 500 mb. Thermal balance calculations indicate that the mean horizontal temperature advection and vertical transverse motion are primarily responsible for maintenance of the temperature structure about a jet. Author (GRA)

N71-27485 Leningrad (A. A. Zhdanov) State Univ. (USSR).
GLOBAL ATMOSPHERIC RESEARCH PROGRAMME (GARP) AND RADIATION FACTORS OF WEATHER AND CLIMATE
K. Y. Kondratyev *In* WMO Radiation Including Satellite Tech, 1970 10 p (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

In this presidential address to the WMO/IUGG symposium held at Bergen in August 1968 different aspects of the regularity of general atmospheric circulation with respect to radiation investigations are analyzed. Special emphasis is given to primary sources of the atmospheric circulation, energy, interaction between the atmosphere and the surface, heat balance of the system surface-atmosphere, radiative heating rate in the troposphere, and to the inverse problems of atmospheric optics and satellite meteorology. ESRO

N71-27489 Main Geophysical Observatory, Leningrad (USSR).
METEOROLOGICAL INTERPRETATION OF INFRA-RED PICTURES OF THE EARTH FROM SPACE
V. L. Gayevsky, K. Y. Kondratyev, Y. P. Novoseltsev, N. Y. Ter-Markaryantz, and V. F. Zhalev *In* WMO Radiation Including Satellite Tech. 1970 p 21-24 refs Prepared jointly with Leningrad Univ. (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

The tracking of cloud distribution over the globe from infrared radiation measurement data using satellite photographs is discussed. The influence of cloud quantity on radiation contrast values of clouds against the surface are investigated. The errors in the determination of the underlying surface and cloud temperature is investigated. It is found that the probable values of radiation temperature contrasts agree with the similar values obtained from direct satellite measurements. ESRO

N71-27497 World Meteorological Organization, Geneva (Switzerland).
SOME DYNAMICAL FEATURES OF THE INDIAN SUMMER MONSOON AS DEDUCED FROM NIMBUS 2 SATELLITE RADIATION DATA
K. R. Saha, D. R. Sikka, and P. Krishna Rao *In its* Radiation Including Satellite Tech. 1970 p 79-83 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

An analysis is presented of Nimbus 2 radiation data applied to the distribution of cloud systems over the Indian Ocean area over a period of three consecutive days when the summer monsoon was in the process of advancing over India. The dynamic origin of the cloud system as revealed by radiation data is discussed. ESRO

N71-27610 Washington Univ., Seattle. Dept. of Atmospheric Sciences.
SOME RECENT DEVELOPMENTS AND NEEDS IN RADIATION CLIMATOLOGY
Norbert Untersteiner *In* WMO Radiation Including Satellite Tech. 1970 p 175–178 (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

As introduction to several lectures on radiation climatology, the need for a collection and critical review of empirical relationship of available data, and for generalization of formula used, are stressed. Application of radiation climatology on numerical models is discussed, including the growth and decay of floating sea ice. ESRO

N71-27611 Main Geophysical Observatory, Leningrad (USSR).
STUDY OF THE REGIME OF ATMOSPHERIC TRANSPARENCY
Z. I. Pivovarova *In* WMO Radiation Including Satellite Tech. 1970 p 181–185 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

The temporal and spatial distributions of the atmospheric transparency factor for the integral flux of solar radiation are analyzed. Maps of atmospheric transparency factors and aerosol components of radiation extinction have been compiled, based on data obtained for the territory of the USSR. It is shown that the direct cause of an extinction in direct radiation is an increase in aerosol turbidity. ESRO

N71-27612 Institut Royal Meteorologique de Belgique, Brussels.
STATISTICAL ANALYSIS OF TURBIDITY FROM 15 YEARS' RADIOMETRIC OBSERVATIONS IN BELGIUM
R. Dogniaux and P. Doyen *In* WMO Radiation Including Satellite Tech. 1970 p 187–189 ref (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

By a statistical compilation of radiometric observations of the classic solar components (direct, global, and diffuse) recorded at Uccle, Brussels, an analytical link between the Linke turbidity factor and the ratio of the diffuse to thg global radiation has been established. At the same timg hourly and seasonal variations of the turbidity factor both for the mean values and for minima have been determined. ESRO

N71-27614 Main Geophysical Observatory, Leningrad (USSR).
THE WORLD ACTINOMETRIC NETWORK AND STUDYING THE RADIATION CLIMATE
T. G. Berlyand *In* WMO Radiation Including Satellite Tech. 1970 p 203–205 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

The present ground actinometric network is presented. The processing of the data by the center for generalization and publication of actinometric data is discussed. ESRO

N71-27617 Main Geophysical Observatory, Leningrad (USSR).
THE RADIATION BALANCE OF LAKES AND RESERVOIRS
T. V. Kirillova *In* WMO Radiation Including Satellite Tech. 1970 p 217–220 (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

Seasonal variation of the ratio of radiation balance of some reservoirs in the USSR to that of surrounding land are discussed, taking into account changes in atmospheric radiation and in the value of emissivity of water surface and land. The reservoir depth influence on the radiation balance has been examined as to its seasonal variation. ESRO

N71-27618 Yale Univ., New Haven, Conn. School of Forestry.
SPATIAL AND TEMPORAL DISTRIBUTION OF SOLAR RADIATION BENEATH FOREST CANOPIES
William S. Reifsnyder, George M. Furnival, and Joseph L. Horowitz *In* WMO Radiation Including Satellite Tech. 1970 p 221–223 (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

A field study was made of the space and time distribution of solar radiation at ground level underneath hardwood and pine canopies. The objectives were to determine and characterize the manner in which short wave radiation penetrates through different crorown canopies, and to calculate statistics of the space and time distribution of the direct and diffuse components of sunlight. With the latter, it is possible to estimate the number of sensors required to sample the radiation in the two stands for any desired level of precision. ESRO

N71-27619 Academy of Sciences (USSR), Moscow. Inst. of Geography.
THE ROLE OF RADIATION IN THE HEAT BALANCE OF THE ICE-COVER SURFACE ON FRANZ JOSEF LAND AND SPITSBERGEN
V. A. Markin *In* WMO Radiation Including Satellite Tech. 1970 p 225–226 (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

A two-year meteorological and actinometric observation was conducted on the summit of ice domes in the control group of islands of Franz Joseph Land and Spitsbergen. It was concluded that the assimilation of solar radiation by the ice surface depends primarily on the atmospheric circulation. ESRO

N71-27620 World Meteorological Organization, Geneva (Switzerland).
RADIATION REGIME OF THE ICE COVER ON THE NOVAYA ZEMLYA
N. V. Davidovich *In its* Radiation Including Satellite Tech. 1970 p 227–228 (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

A survey has been carried out to ascertain the radiation regime in the Novaya Zemlya region. The effects of cloud cover are discussed. ESRO

N71-27621 World Meteorological Organization, Geneva (Switzerland).
ESTIMATES OF SOLAR RADIATION OVER INDIA
H. R. Ganesan *In its* Radiation Including Satellite Tech. 1970 p 235–236 (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

A general Angstrom-type equation for estimating the distribution of the global radiation over India is described. ESRO

N71-27624 Tomsk State Univ. (USSR). Inst. of Technical Physics.
PROPAGATION OF COHERENT AND INCOHERENT RADIATION IN SCATTERING MEDIA
V. E. Zuev, M. V. Kabanov, B. A. Saveljev, I. V. Samokhvalov, V. V. Sokolov et al *In* WMO Radiation Including Satellite Tech. 1970 p 251–253 refs (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

The results of theoretical and experimental investigations of some problems on propagation of coherent and incoherent radiation in different scattering media are considered. The calculation of attenuation coefficients of water clouds, fogs, and haze at a range of wavelength from 0.3 to 25.0 microns has been made. The attenuation coefficients of coherent and incoherent radiation by water fogs are measured. The interference effects for the light scattering by particles are investigated. The experimental investigations of the applicability limit of Bouguer-Beer's law for the description of the measured attenuation of radiation in scattering media are carried out. ESRO

N71-27625 Sud-Aviation, Courbevoie (France).
PRESERVATION OF COHERENCE IN PROPAGATION

THROUGH AN AEROSOL

M. Fournet *In* WMO Radiation Including Satellite Tech. 1970 p 255–259 (See N71-27484 15-13)

Copyright. Avail: NTIS

The phenomena of scattering by aerosols are usually treated as phenomena where coherence is not preserved owing to the obvious disorganization of the optical paths. In actual fact, coherence is never completely destroyed. In certain cases it subsists, even to a high degree, in spite of a considerable amount of extinction. ESRO

N71-27549 National Physical Lab., New Delhi (India).

THE COLD LAYER ABOVE DRY GROUND DURING CLEAR NIGHTS

L. A. Ramdas *In* WMO Radiation Including Satellite Tech. 1970 p 399–406 refs (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

The occurrence of lower temperature at some distance above the ground surface is analyzed from observations carried out at the Poona Agricultural and Meteorological Observatory (India) over several years. The growth of the shimmering pattern during daytime and the collapse toward the ground during the evening, and the growth of the nocturnal inversion layer are discussed. ESRO

N71-27557 Oslo Univ. (Norway). Inst. of Geophysics.

REMARKS ON RADIATION AND ATMOSPHERIC DYNAMICS

Arnt Eliassen *In* WMO Radiation Including Satellite Tech. 1970 p 475–477 refs (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

The need for very accurate and time consuming radiation calculations in dynamical atmospheric models of large scale motions is discussed. The importance of radiation processes to atmospheric models is analyzed. ESRO

N71-27558 National Center for Atmospheric Research, Boulder, Colo.

SIMPLIFICATION OF RADIATIVE COOLING CALCULATION FOR APPLICATION TO ATMOSPHERIC DYNAMICS

Takashi Sasamori *In* WMO Radiation Including Satellite Tech. 1970 p 479–488 refs (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

In atmospheric dynamics thermal radiation plays an important role of energy dissipation of the atmosphere. The main difficulty in computing radiative fluxes lies in the calculations of absorptivities as functions of both path length and temperature. An approximative method eliminating the calculation of the absorption functions is discussed. This method can easily include the corrections due to cloud cover and the correction for the downwards flux at higher surface altitudes. ESRO

N71-27559 Leningrad (A. A. Zhdanov) State Univ. (USSR).

THE SPECTRAL STRUCTURE OF THE RADIATIVE FLUX DIVERGENCE IN THE INFRA-RED (225–2,000/cm)

K. Y. Kondratyev, H. J. Nijlisk, and R. J. Noorma *In* WMO Radiation Including Satellite Tech. 1970 p 491–495 refs (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

The vertical and geographical distribution of the radiative flux divergence is studied both experimentally and by means of calculation. These latter consider results of determining the spectral distribution of the radiative flux divergence at different height levels in the atmosphere with reference to five atmospheric models. ESRO

N71-27807# Environmental Technical Applications Center (Air Force), Washington, D.C.

UNITED STATES NAVAL WEATHER SERVICE WORLD-WIDE AIRFIELD SUMMARIES. VOLUME 10, PART 3: EUROPE (ALPS AND SOUTHWEST EUROPE)

Apr. 1970 408 p

(AD-720708) Avail: NTIS HC$6.00/MF$0.95 CSCL 4/2

The volume provides climatological summaries for airfields and climatic areas in the Alps and S. W. Europe. Summaries are arranged according to numbered climatic areas, and by increasing WMO Station Index Numbers within the climatic areas. Author (GRA)

N71-27813 Meteorological Office (Gt. Brit.).

CIRCULATION PATTERNS AT 850, 700, 500 AND 200 MILLIBARS OVER THE EASTERN HEMISPHERE FROM 40 DEG N TO 40 DEG S DURING MAY AND JUNE

P. B. Wright and M. W. Stubbs London HMSO 1971 105 p refs *Its* Geophys. Mem. No. 114 (Vol. 15, No. 4)

(Met-O-808d) Copyright. Avail: HMSO £3; BIS $10.80

The area for which the investigation was carried out extends from 40 N to 40 S and from 20 W through India to 150 W. The levels studied were 850, 700, 500, and 200 mb. Data for the months of May and June for the years 1956–60 were analyzed, and 5-year streamline/isotach charts were prepared. The most useful charts were those for the middle decad of May (11th–20th), D14, and the middle decad of June (10th–19th), D17. Mean flow charts and vertical cross sections of wind for individual decads were also prepared and show that the period of transition varies from year to year; for example in early June 1956 over India the main part of the change in the circulation patterns had already taken place whereas at the same time in 1958 it had not yet started. Some of the charts and cross sections for decads of individual years are presented, in order to illustrate the patterns to be expected while the changes are taking place and to highlight some of the differences between the years. Author

N71-27830# Environmental Technical Applications Center (Air Force), Washington, D.C.

US NAVAL WEATHER SERVICE WORLD-WIDE AIRFIELD SUMMARIES. VOLUME 10, PART 4: EUROPE (MEDITERRANEAN)

Apr. 1971 389 p

(AD-721160) Avail: NTIS HC$6.00/MF$0.95 CSCL 4/2

The volume is part of a series of compilations which is world-wide in scope. It consists of climatological summaries for selected airfields and for the climatic areas in which they are located. The volume provides climatological summaries for airfields and climatic areas in the Mediterranean. GRA

N71-27843# Allied Research Associates, Inc., Concord, Mass.

STUDIES OF STORMS BY DOPPLER RADAR Final Report, 16 Feb. 1970–15 Mar. 1971

Raymond Wexler 26 Mar. 1971 47 p refs

(Contract F19628-70-C-0205)

(AD-720872; ARA-9G76-F; AFCRL-71-0148) Avail: NTIS CSCL 4/2

Wind field and convergence were determined by Doppler radar in a 14-hour storm, 10-11 Feb. 1970, characterized by continuous rain and heavy shower activity. The wind field was quite variable at all levels. Some of the variability may have been due to vertical motions in the vicinity of heavy showers. Intermittent discontinuities in the wind field below 1.5 km during a three-hour period are interpreted to be due to the descent of high velocity air from upper levels in downdrafts generated by intense shower activity. The convergence field was characterized by general convergence at low levels and divergence at upper levels during most of the storm. In the storm of 2 April 1970, a southwesterly jet of 38 to 45 m/sec prevailed at 2 to 6 km. Lower velocities from above penetrated to the 5 or 6 km level for a period of about two hours. During this period there were discontinuities in the wind

field over a 15-minute period which occurred first at 6 to 6.6 km and then 12 minutes later at 4.9 to 6 km. These discontinuities coincided with sharp increases in reflectivity on the edge of heavy showers. These discontinuities are interpreted to be the result of the interaction of the environmental wind with the cumuliform towers characterized by strong updrafts and heavy shower activity. Author (GRA)

N71-27844*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NUMERICAL SOLUTION FOR CHEMICALLY GENERATED WAVES IN A DILUTE, ISOTHERMAL ATMOSPHERE

Igor J. Eberstein and Kenneth D. Shere Apr. 1971 25 p refs Submitted for publication

(NASA-TM-X-65560; X-651-71-195) Avail: NTIS CSCL 04B

The behavior of chemically generated waves in a simplified atmosphere was studied. The atmosphere is assumed unbounded, isothermal, one-space-dimensional and initially quiescent. At an initial time a dissociation reaction, AB + J yields A + B + J, commences and drives the subsequent wave motion. The fraction of reactant in the atmosphere, X sub 0, is assumed to be small. The system of governing equations is then expanded in terms of the small parameter, X sub 0, and an asymptotic integral solution as X sub 0 yields 0 is obtained. Author

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N71-26961# California Univ., Livermore. Lawrence Radiation Lab.

NEW CONCEPTS FOR GEOGRAPHIC POSITION LOCATORS

M. R. Gustavson and J. D. Salisbury 10 Sep. 1970 27 p refs

(UCRL-50978) Avail: NTIS

The geographic position locator (GPL) – a small, self contained system for accurate, long term, land based navigation – is described, with particular emphasis on the means for automatically minimizing its position errors. Use is made of the normal rest periods of land-based systems to reduce position errors and improve the subsequent navigational accuracy. Compared to continuous navigation, at least a tenfold reduction in position error appears achievable even under extremely adverse conditions. Operation could be fully automatic, a motion state sensor being used to activate the error minimization process during stationary periods. Author

N71-26970# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.

RADAR AND RADIONAVIGATION: A BIBLIOGRAPHICAL STUDY [RADAR UND RADIONAVIGATION: EINE LITERATURSTUDIE]

Wolfgang Reinhardt Dec. 1970 52 p refs In GERMAN; ENGLISH summary

(DLR-MITT-70-21) Avail: NTIS; ZLDI Munich: 13.70 DM

Guided by papers published during the last two years an attempt is made to point out the highlights of the technological development of radar and radionavigation for aviation and to predict further development of these fields for the years to come. Critical comments are made on the development of primary and secondary radar systems on board and ground-based, the aeroplane navigation in the close-range of airports and in the long-range on the flight route as well as on the possibility of traffic control by means of satellites across the oceans. Author (ESRO)

N71-26983# Naval Postgraduate School, Monterey, Calif.

ANALYSIS OF A PROPOSED DIFFERENTIAL OMEGA SYSTEM

Michael Eugene McKaughan (M.S. Thesis) Dec. 1970 73 p refs

(AD-721108) Avail: NTIS CSCL 17/7

Omega, a world-wide, VLF, CW, all-weather navigation system offers one mile resolution, but suffers in accuracy due to propagation anomalies which have been found to be relatively constant over differential areas. Differential Omega is the process of disseminating propagation-produced error to users in the differential area. Accuracy improvements of 5 to 1 are possible. A system of Differential Omega using a Coast Guard Radiobeacon was proposed by Goodman. His system has been reviewed and improvements suggested. The correction message format was reviewed and changed to include line of position (LOP) identification. A revised transmitting scheme using a master oscillator controlled frequency synthesis process with digital readout is evaluated. Using the frequency synthesized master oscillator controlled Differential Omega system, accuracies of 30 yards can be realized for idealized Omega receiver inputs. Author (GRA)

N71-27179# Naval Observatory, Washington, D.C.

SCHEDULE OF NAVAL TIME SIGNAL TRANSMISSIONS

Gernot M. R. Winkler 12 Feb. 1971 5 p *Its* Time Serv. Announcement Ser. 2, No. 12

(AD-721350) Avail: NTIS CSCL 17/7

The U. S. Navy transmits second pulses for the purpose of precise navigation from some HF and VLF stations. The document gives the location of those stations and lists the time and format of those transmissions. Author (GRA)

N71-27268# Naval Research Lab., Washington, D.C.

PROBABILITIES OF SUCCESSFUL DATA ASSOCIATION FOR TRACKING IN THE PLANE WHEN USING MAXIMUM LIKELIHOOD ASSOCIATION PROCEDURES

M. E. B. Owens 2 Feb. 1971 16 p ref

(AD-720310; NRL-7182) Avail: NTIS CSCL 15/7

Data association is the determination of which subset of data contained in a larger set is related to a specific entity. The problem of data association is examined in an ocean surveillance environment in which the entities are vessels and the available data referring to the state of these vessels is either position, position and speed, or position, course, and speed. It is assumed that the vessels are uniformly and independently distributed over the ocean region of interest and that the total number of vessels in the region is known. For each data mix the maximum likelihood procedure for associating data referring to a particular vessel is given. Then a derivation is given for the probability that the data associated using this procedure actually refers to the state of the particular vessel. These probabilities are not only a function of the data mix available but also a function of the accuracies of the data and the number of vessels in the area of interest. Author (GRA)

N71-27324* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GRAVITY GRADIENT ATTITUDE CONTROL SYSTEM Patent

James A. Gatlin, Henry C. Hoffman, Henry W. Price, and Benjamin G. Zimmerman, inventors (to NASA) Issued 2 Mar. 1971 7 p Filed 20 Dec. 1968 Cl. 244-1; Int. Cl. B64g1/00

(NASA-Case-GSC-10555-1; US-Patent-3,567,155; US-Patent-Appl-SN-785620) Avail: US Patent Office CSCL 17G

A system for controlling and stabilizing the attitude of an artificial earth satellite is described which includes a gravity gradient member mounted in a gimbal arrangement to have 2 degrees of freedom. The angular deviation of the gravity gradient member and the satellite relative to the local vertical and the spacecraft

angle command input signal selectively drive a plurality of inertial momentum wheels, one for each of the three spacecraft axes, provided to dampen the gravity gradient member librations. The gravity gradient member is controlled so that the equilibrium position of the longitudinal axis is maintained in alignment with the local vertical in response to signals indicative of the rate of change of movement with respect to the remainder of the satellite and a signal indicative of the angular deviation of the satellite position from the angle command. Official Gazette of the U.S. Patent Office

N71-27606*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE ATTITUDE STABILITY OF THE SAS A SPACECRAFT
G. Fleisher and A. K. Sen Mar. 1971 14 p refs
(NASA-TM-X-65557; X-732-71-187) Avail: NTIS CSCL 22B

An attempt is made to identify and model energy dissipation in the body as well as in the momentum wheel of the SAS-A spacecraft. The effects of energy dissipation on system stability is analyzed. Author

N71-27738*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VEHICLE ATTITUDE: AN ANALYSIS OF FLIGHT 4.272UA
Charles F. Miller, Jr. Mar. 1971 34 p Prepared in part by N.Mex. State Univ. and Minn. Univ.
(NASA-TM-X-65570; X-743-71-103) Avail: NTIS CSCL 22A

A brief case history is given of the determination of sounding rocket attitude by means of solar aspect sensors and magnetometers, as applied to NASA Rocket Flight 4.272 UA. Author

N71-27845# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
A STUDY OF AN AUTONOMOUS UNKNOWN LANDMARK TRACKING NAVIGATION SYSTEM Research Report, Sep.–Dec. 1970
Howard T. Hendrickson 1 Feb. 1971 21 p refs
(Contract F04701-70-C-0059)
(AD-720241; TR-0059(6311)-4; SAMSO-TR-71-63) Avail: NTIS CSCL 17/7

A prime candidate for autonomous space navigation is unknown landmark tracking. An Aerospace Corporation digital computer program called ONAP (Orbit Navigation Analysis Program) was used for a simulation study of autonomous unknown landmark tracking. This program employs a sequential filter and provides both error analysis and Monte Carlo simulation capabilities. It also allows for the inclusion of all significant error sources, i.e., initial landmark location errors, instrument errors, attitude errors, geopotential and atmospheric model errors, and initial condition errors. The study included the generation of algorithms to avoid numerical problems resulting from limited state vector observability. Various successful initialization schemes were considered, including the one recommended by Bellantoni. A baseline system with all error sources considered was studied and found to be feasible if the proper algorithm was selected. Author (GRA)

N71-27846*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A CONCEPT FOR A LEARNING ATTITUDE CONTROL SYSTEM FOR LAUNCH VEHICLES
Juergen K. Baumeister 20 Apr. 1970 35 p refs
(NASA-TM-X-64518) Avail: NTIS CSCL 22B

Literature studies and computational investigations are used to outline a rough concept of a digitalized adaptive or learning control system for any high performance space launcher, space shuttle, or aircraft. The concept gives special attention to practical applicability in terms of performance and complexity and serves as a baseline for further investigations and development. Alternative algorithms and procedures for the appropriate subroutines of the system, taken from statistics, digital filtering, and control engineering, are discussed. The proposed system is subdivided into identification, optimization, and online control. Author

N71-27847*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEODETIC SATELLITE RESULTS FOR DEEP SPACE STATION COORDINATES
B. C. Douglas (Wolf Res. and Develop. Corp., Riverdale, Md.), J. G. Marsh, and S. M. Klosko (Wolf Res. and Develop. Corp., Riverdale, Md.) Feb. 1971 17 p refs
(NASA-TM-X-65550; X-552-71-109) Avail: NTIS CSCL 17G

Deep space station coordinates inferred from near earth satellite solutions for nearby optical and Doppler tracking sites are compared to those obtained from tracking of deep space vehicles. Comparisons of results for longitude differences and spin axis distances show especially close agreement between optical results, although agreement is very good for all the various solutions. The results of these comparisons show that the GEOS-1 and 2 optical flash data have yielded results equal or superior to those of other systems. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N71-26824# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.
PROCEDURE FOR IDENTIFICATION OF FUEL ELEMENT SPHERES OF HIGH TEMPERATURE REACTORS WITH THE HELP OF EMISSION SPECTRAL ANALYSIS AT 40 ATMOSPHERES OF HELIUM [EIN VERFAHREN ZUR IDENTIFIZIERUNG VON BRENNELEMENTKUGELN DES HOCHTEMPERATURREAKTORS MIT HILFE DER EMISSIONSSPEKTRALANALYSE BEI 40 AT HELIUM]
Peter Rolf Lingen (Ph.D. Thesis–Tech. Hochschule, Aachen, West Ger.) Jul. 1970 89 p refs In GERMAN
(JUL-671-RW) Avail: AEC Depository Libraries

For emission spectrometry under 40 atm helium, the optimal combustion conditions were determined. Operating voltage characteristics, temperature determinations, burning off of the cathode and anode, radiation strength, and dependence of line and continuum intensity on pressure are discussed. The possibility of the sorting of graphite fuel spheres with broken coated particles and detection of labeled spheres for charge identification is considered. A completely automatic spark chamber for rapid analysis of spherical elements is being built. NSA

N71-26850# Oak Ridge National Lab., Tenn.
REFERENCE DESIGN FOR AN ISOTOPE POWER UNIT EMPLOYING AN ORGANIC RANKINE CYCLE
G. Samuels and R. S. Holcomb Jan. 1971 78 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2960) Avail: NTIS

The heat source consists of seven SrTiO3 fuel elements 3.40 in. in diameter and 38.4 in. in length encapsulated in Hastelloy C-276. The unit is designed for undersea operation at a depth of 6000 ft and 5 yr life. The required beginning-of-life thermal output is 34 kW. The fuel elements are located on a triangular pitch in the center of a low-carbon steel heat block-shield which serves as both the shield and as a heat conductor to transfer

the heat from the fuel to reentry boiler tubes located in the outer part of the shield. Saturated vapor at 600 F from the 12 reentry boiler tubes passes through a combined separator boiler drum, to the turbine and then through the regenerator to the upper head of the pressure vessel which serves as the condenser. The liquid from the condenser flows to the feed pump, passes around and cools the generator, then through the regenerator and back to the boiler drum. Author (NSA)

N71-28853# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
SAFETY REPORT FOR FR-2 EXPERIMENTAL CAPSULE RIGS WITH SINGLE WALLED NaK CAPSULES FOR IRRADIATION OF HIGH POWER FUEL PINS
H. Haefner Jan. 1970 3 p refs Transl. into ENGLISH of German report KFK-1143 Sponsored by US-EURATOM Fast Reactor Exchange Program
(EURFNR-764; DWR-1649; KFK-1143) Avail: NTIS

Irradiation of mixed UC-PuC fuel pins of lengths up to 1 m will be performed in the FR2 reactor. At the initial stage, pins of 475 mm length (300 mm fuel length and 10 mm outer diameter of the cladding tube) will be introduced including pins with He and Ar bonding as well as with Na bonding. The central fuel temperature (2,000 C max.) will be measured in the case of fuel pins with gas bonding. Maximum pin power is intended to be 1,150 W/cm for a temperature of the cladding tube surface of 630 C; the burnup is limited to 50,000 MWd/te of fuel. For the purposes of this irradiation experiment, a capsule for a high pin power was developed using NaK as heat transfer medium which surrounds the fuel pin. The separation between NaK and the reactor cooling water is achieved by only one wall which consists of a capsule tube of Nb-1%Zr. An intermediate tube with good thermal conductivity is fitted into the NaK gap in order to achieve lower heat flux densities on the capsule surfaces and to avoid convection in the NaK. In addition to the description of the capsule rigs and their operational behavior, the actual safety considerations which play a particularly important part because of the possible risks of NaK/water reactions resulting from a leak in the capsule are included. Author (NSA)

N71-28854# Scientific Research Atomic Reactor Inst., Melekess (USSR).
MECHANISM OF GAS RELEASE FROM CERAMIC NUCLEAR FUELS [O MEKHANIZME GAZOVYDELENIYA IZ KERAMICHESKOGO YADERNOGO GORYOCHEGO]
E. F. Davydov, V. Ya. Zavidovski, V. N. Syuzev, and Yu. V. Chushkin 1970 28 p refs In RUSSIAN
(SRARI-P-73) Avail: AEC Depository Libraries

Based on the analysis of literature data and other investigations, a trap mechanism for gas release is proposed. On this basis the behavior of inert gases in nuclear fuels is explained. Special experiments at preset temperatures and burnups allowed establishment of the relation between the quantity of gas released during annealing and structural defects behavior. The hypothesis of two stages of gas release occurring during annealing is introduced. Feasible ways of controlling deleterious consequences from fission gas fragments are considered. Author (NSA)

N71-28858# Israel Atomic Energy Commission, Tel Aviv.
OJHAZ: A PROGRAM FOR THE EVALUATION OF ENVIRONMENTAL HAZARDS FROM NUCLEAR REACTORS
Y. Milman and J. Tadmor Jun. 1970 28 p refs
(IA-1206) Avail: AEC Depository Libraries

A program for numerical calculation of environmental hazards resulting from an accident in a nuclear reactor is described. Nuclear, meteorological and radiological subroutines are presented in detail, and a glossary of symbols, program write-up and a sample calculation are given. The program is written in ALTAC language for the PHILCO 2000/212 computer. NSA

N71-28926# Atomic Energy Commission Research Establishment, Luces Heights, (Australia).
FLOW OF SPHERES IN CYLINDRICAL VESSELS. PART 2: PEBBLE TRANSIT IN RECIRCULATED RANDOM PACKINGS
F. C. Gatt Jun. 1970 30 p refs
(AAEC/E-207-Pt-2) Avail: AEC Depository Libraries

An experimental and statistical investigation was made of the transit of invidivual pebbles in recirculated random packings of equal spherical pebbles. Slightly aspherical pebbles were also studied. Pebbles of 1.00 in. or 0.75 in. nominal dia were used to form 30 in. deep beds in a 30 in. dia vessel with a concave base in the form of a cone with 25 deg slope. The independent variables whose effects were studied were the radial position of the pebble, the number of pebbles in the bed situated beneath the seeding position, the pebble size and sphericity, and the amount of recirculation. Both transient and equilibrium conditions were considered. An estimate was made of the mean amount of recirculation required to reach equilibrium from an initially random packing. For spherical pebbles this was approximately 1.6 times the number of pebbles in the bed, and for aspherical pebbles it was 2.8 times the number. Formulas are given for predicting the amount of recirculation required for a particular pebble to emerge from the bed. Author (NSA)

N71-28927# WADCO Corp., Richland, Wash.
IRRADIATION OF BORON CARBIDE PELLETS AND POWDERS IN HANFORD THERMAL REACTORS
A. L. Pitner and G. E. Russcher Dec. 1970 40 p refs
(Contract AT(45-1)-2170)
(WHAN-FR-24) Avail: NTIS

Natural boron carbide pellets and powders were irradiated in Hanford thermal production reactors at 500 to 1200 F to a maximum average B-10 burnup of 18%. Sample forms were 65, 80, and 99% TD pellets and 60 and 80% TD powders. The high density materials exhibit greater peak-to-average burnup ratios due to self shielding. Metallographic examination disclosed that 99% TD pellets suffered severe damage near the surface but appeared unreacted in the inner core. The 65 and 80% TD pellets experienced radial cracking with no apparent skin burnup effect. Powders exhibited the highest gas release rates. Intermediate density pellets (65 and 80% TD) released less gas than the powders. The 99% TD pellets released less gas than any of the other samples. Gas release in the pellets invreased rapidly as the irradiation temperature exceeds 1000 F. An analysis of exposure conditions for the specimens tested and those irradiated in other thermal reactors indicated that spectral differences and sample geometry must be considered when evaluation the irradiation behavior of boron carbide. Author (NSA)

N71-28928# WADCO Corp., Richland, Wash.
FISSION GAS BUBBLE PRECIPITATION AND GROWTH IN PuO2-UO2 UNDER IRRADIATION
D. C. Bullington and R. D. Leggett 13 Jul. 1970 9 p refs Presented at the 4th Intern. Conf. on Plutonium and Other Actinides, Santa Fe, N.Mex. Sponsored by AEC
(WHAN-SA-15; CONF-701001-14) Avail: NTIS

The intergranular pore density was determined at two axial positions in a mixed oxide fuel pin irradiated in EBR-2 to a peak burnup of 1 percent of the heavy atoms. The pore size was approximately that calculated, however, no dependence of pore size distribution with local temperature or temperature gradient was found. The volumetric average intergranular pore volume was found to be greater in the fuel operating at the lowest burnup rate. The study indicated that unetched fuel is more suitable for measurement of special pore distributions than etched samples. Author (NSA)

N71-28929# WADCO Corp., Richland, Wash.
SIMULATION OF PIPING LENGTHS IN SODIUM SYSTEMS
A. L. Gunby Dec. 1970 38 p refs

(Contract AT(45-1)-2170)
(WHAN-FR-22) Avail: NTIS

Several models for sodium piping were examined using example pipe sizes and example flow and temperature transients. A reference model (alternating central difference and three point backward differences at each axial mesh point) was selected to describe the effect of pipe wall stored heat on coolant thermal transients. Model simplifications were investigated. The investigation resulted in a model using a transport delay in series with a single node for stored heat effects with sodium and metal volumes altered by appropriate fractions. Author (NSA)

N71-28938*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODIFICATIONS OF THE CYGRO-2 COMPUTER PROGRAM
Ivan B. Fiero Washington May 1971 51 p refs
(NASA-TM-X-2150) Avail: NTIS CSCL 18I

Modifications made to the CYGRO-2 computer program are presented. The CYGRO-2 program is a Westinghouse-Bettis-developed program for the mechanical analysis of irradiated, cylindrical geometry, nuclear reactor fuel pins subjected to fuel swelling due to the fission products. The modified program is compatible with the IBM 7094 computer. Results of the modifications are shorter computer times and improved covergence. A sample problem for a uranium mononitride fuel pin is included, with detailed discussion of input data and the difficulties encountered. Computer problems encountered in using the program are detailed both in the discussion of the modification and in the discussion of the sample problem. Author

N71-28962# Sandia Corp., Albuquerque, N.Mex.
EFFECTS OF LOAD CONDITIONS ON LONG TERM RADIOISOTOPE THERMOELECTRIC GENERATOR OPERATION
I. G. Waddoups Dec. 1970 64 p refs Sponsored by AEC
(SC-RR-70-854) Avail: NTIS

Results of the analysis performed indicate that both the effects of decreasing heat input and the system load conditions must be considered in order to obtain maximum performance at end-of-life (EOL). Furthermore, this maximum EOL performance does not occur at the same load condition for maximum beginning-of-life performance. Author (NSA)

N71-28963# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
DESIGN AND TESTING OF THE SEFOR FAST REACTIVITY EXCUSION DEVICE (FRED)
E. R. McKeehan Oct. 1970 68 p
(Contract AT(04-3)-540)
(GEAP-13649) Avail: NTIS

The primary objective of FRED design is to provide a reliable device that can rapidly move a poison slug from the reactor core at a predictable rate regarding the time and the desired conditions. To accomplish this objective, a pneumatically actuated device was designed and extensively tested. This device has demonstrated reliable and reproducible performance and has many inherent safety features which are discussed. In reviewing the design of the FRED and the reactor operations with the FRED, the most significant items considered are discussed in detail. Author (NSA)

N71-28975# Braun (C. F.) and Co., Alhambra, Calif.
DESIGN GUIDE FOR LMFBR SODIUM PIPING
1 Feb. 1970 415 p refs
(Contract AT(04-3)-781)
(SAN-781-1) Avail: NTIS HC$6.00/MF$0.95

The Piping Design Guide for LMFBR sodium piping is intended to provide up-to-date technology for design and analysis of sodium piping systems. It is part of the LMFBR program plan to develop the overall technology for eventual construction and operation of fast breeder sodium cooled demonstration power plants. It incorporates applicable provisions of current codes along with new criteria and procedures to direct and assist the designer in solving the complex problems posed by the development of LMFBR technology. Periodic revision of this document is contemplated to keep pace with the rapidly developing technology. Author (NSA)

N71-28980# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
COMPUTER PROGRAM FOR CORRELATION AND SPECTRAL ANALYSIS OF REACTOR FLOW DATA
S. Dyer Harris Jan. 1971 32 p refs
(Contract AT(07-2)-1)
(DP-1244) Avail: NTIS

The computer program for correlation and spectral analysis of reactor flow data operates on stationary time series data to obtain any or all of the following statistics: mean, variance, standard deviation, probability density function, autocorrelation and cross-correlation functions, and the frequency spectrum (Fourier transform). The program is limited to two data records, each up to 2000 points in length. These limits could be increased to accommodate longer records. Statistics that have a functional variation are presented graphically with the option provided for detailed listing of functional values. The program can be expanded to include other operations on the data by adding the appropriate subroutine package, the data set being available in common storage. Author (NSA)

N71-28989# Atomic Energy Commission, Washington, D.C.
VELOCITY FIELD OF TURBULENT FLUID FLOW IN A LONGITUDINAL STREAMLINE OF CLUSTERS OF RODS
V. I. Subbotin et al Feb. 1971 34 p Transl. into ENGLISH of Russian report
(AEC-tr-7189) Avail: NTIS

In the active zones of nuclear reactors and steam generators, the flow of the cooling agent can proceed in channels with noncircular cross sections, particularly in channels with smoothly packed rods. Results of studies of velocity fields and the hydraulic resistance of turbulent flow in channels, formed by the system of smooth parallel rods, are reported. The rods formed a regular triangular package in the grid. The majority of experimental studies dedicated to the investigation of turbulent flow in channels packed with rods were directed to obtaining friction coefficients necessary for calculation of the power for passage of the cooling agent. Local flow characteristics were found basically by methods of theoretical calculation. Velocity fields, distributions of tangential stress over the perimeter of the entire channel, and data on resistance were obtained in the experiments. Measurements in the channels were carried out in the area of stabilized air flow. NSA

N71-28994# Gulf General Atomic, San Diego, Calif.
REVIEW OF GULF GENERAL ATOMIC SUPPORT OF THE HIGH TEMPERATURE LATTICE TEST REACTOR PROGRAM
J. R. Brown, D. R. Mathews, and T. N. Chryssikos 24 Nov. 1970 34 p refs
(Contract AT(04-3)-167)
(GAMD-10231) Avail: NTIS

The HTLTR experimental program has been involved with measurements on Lattices 1 and 2. The experimental program on each lattice involves measurements of k sub infinity and the thorium Doppler coefficient at various temperatures up to 1000 C. At room temperature, measurements of central cell absorption rates are made using foil-activation techniques for use in the subsequent data reduction. A separate set of room-temperature experiments were performed in the Physical Constants Test Reactor with Lattice 2 to evaluate the experimental techniques used in the HTLTR and their underlying theoretical basis. Author (NSA)

N71-27012# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.

INFLUENCE OF THE METHOD OF CALCULATION ON THE MULTIPLICATION FACTOR k(eff) AND THE VOID EFFECT DELTA k(V) FOR A LARGE FAST SODIUM COOLED BREEDER REACTOR [EINFLUSS VON BERECHNUNGS METHODEN AUF DEN MULTIPLIKATIONSFAKTOR k(eff) UND DEN VOIDEFFEKT DELTA k(V) FUER EINEN GROSSEN SCHNELLEN NATRIUMGEKUEHLTEN BRUTREAKTOR]

K. E. Schroeter (Ph.D. Thesis – Tech. Hochschule, Karlsruhe, West Ger.) Apr. 1970 233 p refs In GERMAN; ENGLISH summary

(KFK-1180) Avail: AEC Depository Libraries

The uncertainties associated with the nuclear parameters for large fast reactors are due to uncertainties in the nuclear data and calculational methods. For a standard system the influence of different calculational methods on the multiplication factor k(eff) and the void effect Delta k(V) is analyzed. After an analysis of the void effect (dependence on the reaction types, energy and space) the influence of changes in macroscopic cross sections on k(eff) and Delta k(V) is investigated and explained. This results in a method of anticipating changes in the void effect for specific changes of the system. These preconditions will allow an explanation of the influence of the methods considered. The resulting corrections for k(eff) and Delta k(V) are summarized in two tables. Depending on the compilation of individual corrections, total corrections for k(eff) are obtained ranging from 2.1% to 2.94% and for Delta k(V) from 36% to 20%. Author (NSA)

N71-27023*# Humphreys Corp., Concord, N.H. TAFA Div.

RADIATION MEASUREMENTS AND LOW FREQUENCY AND HIGH PRESSURE INVESTIGATIONS OF INDUCTION HEATED PLASMA

Charles E. Vogel, John W. Poole, and Peter H. Dundas Washington NASA May 1971 65 p refs

(Contract NAS3-13225)

(NASA-CR-1804) Avail: NTIS CSCL 20I

A number of induction coupled plasma torches were operated under a variety of test conditions to simulate various requirements for the gas core nuclear rocket. Specifically, tests were operated at 4 MHz, 9,600 Hz, and 960 Hz. At 4 MHz, pressures up to 715 psia were obtained. Testing at 9,600 Hz and 960 Hz was performed up to 1 atmosphere and 300 mm respectively. In addition to obtaining radiation data, these tests provide operating techniques and design principles which will permit operating an induction coupled plasma torch at extremely high powers and pressures thereby more closely simulating the gas core nuclear rocket. Plots are presented showing the relationship of frequency, pressure, gas type, torch diameter, minimum operating power, and coupling efficiency. Author

N71-27024# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerperforschung.

UA13-Al AS DISPERSION FUEL FOR HIGH FLUX REACTORS [UAl3-Al ALS DISPERSIONSBRENNSTOFF FUER HOECHSTFLUSSREAKTOREN]

S. Nazare, G. Ondracek, and F. Thuemmler 13 Aug. 1970 83 p refs In GERMAN; ENGLISH summary

(KFK-1252) Avail: AEC Depository Libraries

The interaction between the phases and the properties of UAl3-Al dispersions is reviewed. The preparation of single phase UAl3 and fabrication of fuel dispersions with Al are described. Hot rolling of Al clad fuel element plates of this dispersion is also described. Metallographic and X-ray methods are used to control the quality of such fuel plates. The kinetics of this reaction were studied qualitatively with a hot stage microscope and quantitatively with a dilatometer as well as quantitative metallography. Addition of ternary elements such as Si (3 wt %) can suppress the reaction. Some properties of such dispersion (thermal expansion, thermal and electrical conductivity, Young's modulus, and 0.2% proof stress and tensile strength) were measured as a function of the UAl3-concentration. The influence of the reaction on properties was investigated. The 0.2% proof stress and tensile strength of Al-clad fuel plates were obtained as a function of the temperature. The results are discussed in the light of existing theories. Author (NSA)

N71-27078# WADCO Corp., Richland, Wash.

STRUCTURE EVOLUTION IN AN OXIDE FUEL PIN

J. A. Christensen 27 Oct. 1970 11 p ref Presented at the Meeting of the Am. Ceramic Soc., San Francisco, 27–29 Oct. 1970

(Contract AT(45-1)-2170)

(WHAN-SA-79; CONF-701037-1) Avail: NTIS

The development of mixed oxide fuel rods is described. Performance characteristics of PuO2-UO2 fuel rods are discussed. Radiation effects on structural changes are analyzed. NSA

N71-27087# Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Fuel Div.

SAXTON CORE 2 NUCLEAR OPERATIONS SUMMARY

R. L. Thompson, A. J. Impink, and R. W. Colombo Dec. 1970 98 p Sponsored in part by AEC

(WCAP-3385-55; EURAEC-2108) Avail: NTIS

The Saxton Core 2 fuel loading consisted of nine central PuO2-UO2 fuel assemblies and twelve outer enriched UO2 fuel assemblies. The mixed oxide contained 6.6 w/o PuO2 in natural UO2. The mixed-oxide rods were clad with Zircaloy-4 with the exception of a few special test rods clad with stainless steel. Core 2 operated for 9,390 effective full power hours before shutdown. During the operation periodic measurements were made to determine the system reactivity, control rod and boron worth, flux and power distributions, burnup, and temperature, pressure, and power coefficients. The results of these measurements are presented and compared to analytic predictions. NSA

N71-27088# Scientific Research Atomic Reactor Inst., Melekess (USSR).

AN AMPOULE CHANNEL FOR THE IRRADIATION OF CONSTRUCTION MATERIALS IN AN SM-2 REACTOR WITH TEMPERATURE ADJUSTMENT BY VARYING THE SIZE OF THE GAS GAP [AMPULNYI KANAL DLYA OBLUCHENIYA KONSTRUKTSIONNYKH MATERIALOV V REAKTORE SM-2 S REGULIROVANIEM TEMPERATURY IZMENENIEM VELICHINY GAZOVOGO ZAZORA]

G. P. Lobanov, B. V. Samsonov, R. A. Timchenko, V. A. Tsykanov, and V. N. Shulimov 1969 22 p refs In RUSSIAN

(SRARI-P-56) Avail: AEC Depository Libraries

The construction description and principal capsule channel characteristics destined for the construction materials irradiation under an elevated temperature (>500 C) in SM-2 reactor are given. The channel construction permits a temperature adjustment of specimens during irradiation by varying the thermal resistance value (the helium gap thickness) between specimens in which heat is generated, and by the reactor coolant removing this heat from the capsule channel body. Author (NSA)

N71-27124# Kernforschungszentrum, Karlsruhe (West Germany).

PHYSICS INVESTIGATIONS OF STEAM-COOLED FAST REACTOR CORES WITH A PLUTONIUM FUELED CENTRAL ZONE. SNEAK ASSEMBLY 3B

E. A. Fischer, F. Helm, and H. Werle, comps. Sep. 1970 70 p refs Sponsored by US-EURATOM Fast Reactor Exchange Program

(EURFNR-848; KFK-1266; EUR-3969) Avail: AEC Depository Libraries

In SNEAK assembly 3B the physics parameters of a steam-cooled fast reactor core were investigated, the steam being simulated by polyethylene foils. The core had a central zone fueled with Pu and a surrounding U zone. It was also modified by

introducing Ni and Mo for the simulation of Inconel and by introducing platelets containing a mockup of fission products. The experiments were compared to calculations, often using various nuclear data sets or calculational methods. Author (NSA)

N71-27138# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.
CHANGE IN THERMAL CONDUCTIVITY OF AN OXIDE FUEL ELEMENT DURING BURNUP [AENDERUNG DER WAERMELEITFAEHIGKEIT IN EINEM OXIDISCHEN BRENNELEMENT WAEHREND DES ABBRANDS]
H. Kleykamp Jul. 1970 15 p refs In GERMAN; ENGLISH summary
(KFK-1245) Avail: AEC Depository Libraries

The change in thermal conductivity of mixed-oxide during burnup is discussed. The influence of the porosity and change in stoichiometry as well as the heat-transfer coefficient was estimated. The formation of the fission products during burnup led to a decrease in thermal conductivity. The latter fell by 25% after a burnup of 10% due to the solid solution formation (U,Pu)-oxide-rare earth oxides-zirconia. An increase of about 8% compared with the pure matrix is to be expected in the case of metallic and oxide inclusions in dispersion form. Author (NSA)

N71-27140# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
EL 600: STUDY OF THE CORE NEUTRONIC PROPERTIES [EL 600: ETUDE DES CARACTERISTIQUES NEUTRONIQUES DU COEUR]
Marcel Chabrillac, Stephen Goldstein, Roger Naudet, and Tran Tuc Vi Dec. 1970 57 p refs In FRENCH
(CEA-N-1395) Avail: AEC Depository Libraries

EL 600 is a heavy water moderated and cooled power reactor of the same type as the Canadian Pickering reactor. Results of fundamental neutronic calculations are given: lattice calculations and reactivity coefficients for the fresh fuel; burnup calculations; balance of absorption and reactivity coefficients for the irradiated core; and study of the power and flux distributions in the core at equilibrium. Author (NSA)

N71-27164# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
COREGRAF 2: A CODE FOR COMPUTING GRAPHITE LATTICES AND THEIR EVOLUTION FOR IBM 360 AND CDC 6600 [COREGRAF 2: CODE DE CALCULS DE RESEAUX ET D'EVOLUTION DES RESEAUX A GRAPHITE CODE SPM SUR IBM 360 ET CDC 6600]
Francois Cogne, Alain Hoffmann, and Paul Reuss Dec. 1970 103 p refs In FRENCH
(CEA-N-1344(1)) Avail: AEC Depository Libraries

The COREGRAF 2 code is used for lattices and lattice evolution calculations in the natural uranium graphite moderated gas cooled reactors. It was written in FORTRAN 4 for either IBM 360 or CDC 6600 computers. Owing to the very short computing time (about 0.5 sec on IBM 360-91), it is most convenient for calculations with power reactor lattices. The code uses the secondary model of thermalization (CADILHAC model) and rapidly calculates the diffusion coefficients using the BENOIST formalism. The resonant range is treated in a simple way by using the formulation of the resonance integral obtained from the set of experiments performed on the critical assemblies of MARIUS and CESAR. This procedure leads to an accuracy of between 0.0010010 to 0.0020010 for the reactivity of the graphite gas cooled reactors. Author (NSA)

N71-27165# Atomics International, Canoga Park, Calif.
HELIUM INJECTION AS A TECHNIQUE FOR STUDYING RARE GAS BEHAVIOR IN CARBIDE FUEL
Guy Ervin, Jr. 29 Jan. 1971 27 p refs
(Contract AT(04-3)-824)
(AI-AEC-12984) Avail: NTIS

The method of cyclotron injection of helium into fuel and the subsequent observation of the migration of bubbles during annealing was explored as a means of obtaining basic information about fission gas behavior in ceramic nuclear fuel. As a beginning, the method was applied to uranium carbide containing a dispersion of small tungsten particles. Attachment of bubbles to particles was observed by surface replica electron microscopy. Surface replica observation also indicated that there was substantial bubble migration during high temperature annealing. However, it was difficult to obtain quantitative information by the surface replica technique, and it is likely that transmission electron microscopy would be far superior, as was demonstrated in earlier work on tungsten-containing uranium carbide. Author (NSA)

N71-27166# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.
COMPATIBILITY TESTS WITH UC OF DIFFERING STOICHIOMETRIES AND Fe-Ni-Cr ALLOYS AND THE INFLUENCE OF STABILIZERS [VERTRAEGLICHKEITSUNTERSUCHUNGEN MIT UC VERSCHIEDENER STOECHIOMETRIE UND EISEN NICKEL CHROM LEGIERUNGEN UND DER EINFLUSS VON STABILISATOREN]
O. Goetzmann and D. Scherbl Jun. 1970 28 p refs In GERMAN; ENGLISH summary
(KFK-1213) Avail: AEC Depository Libraries

Compatibility tests were carried out at 900 C on Fe-Ni-Cr alloys and UC of varying carbon contents and with stabilizers added. The carbon contents were 4.1, 4.8, and 5.22 wt %. Chromium and vanadium were used as stabilizers for fuels with the hyperstoichiometric composition and $Cr_{23}C_6$ and VC for the substoichiometric composition, respectively. The stabilizer was mixed with the fuel powder. The mixture was not annealed to reach an equilibrium. No great effect of the stabilizers on the reaction of the substoichiometric fuel with the cladding materials was detectable. There was always a strong reaction. The interactions between the stoichiometric and hyperstoichiometric UC and the cladding materials were less than those found with the substoichiometric UC. With the hyperstoichiometric UC there was a remarkable effect of the stabilizers on the reactions with the cladding materials. Author (NSA)

N71-27167# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
MECHANICAL PROPERTIES OF PLUTONIUM BASED CERAMICS AT HIGH TEMPERATURE. APPLICATION TO FUEL ELEMENTS [PROPRETES MECANIQUES A HAUTE TEMPERATURE DES CERAMIQUES A BASE DE PLUTONIUM APPLICATION AUX ELEMENTS COMBUSTIBLES]
Charles de Novion and Robert Lallement 1970 17 p refs Presented at Meeting of the French Soc. of High Temp., Clermont-Ferrand, France, 26 – 27 Oct. 1970
(CEA-CONF-1670; Conf-701028-1) Avail: AEC Depository Libraries

Results of creep rate measurements carried out under compression and at high temperature on mixed uranium and plutonium oxides and carbides are presented. The creep rate depends to a large extent on the composition and porosity of the compounds studied. It is shown how nuetron irradiation modifies the results of experiments outside the pile. From these results it should be possible to estimate the swelling caused by fission products and to foresee the deformation of fuel element cladding as a function of burnup. Author (NSA)

N71-27168# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
CRITICAL AND SAFE DIMENSIONS OF CONTAINERS FOR STORAGE AND MIXING OF PLUTONIUM CONTAINING NUCLEAR FUEL [KRITISCHE UND SICHERE

ABMESSUNGEN VON BEHAELTERN ZUR LAGERUNG UND MISCHUNG PLUTONIUMHALTIGER KERNBRENNSTOFFE]
H.-W. Wiese May 1970 14 p refs In GERMAN; ENGLISH summary
(KFK-1192) Avail: AEC Depository Libraries

Production of fuels for breeder reactors involves the problem of storage and mixing of plutonium-containing nuclear fuel in containers under criticality safe conditions. An assembly is considered safe against criticality when its fuel volume is at most 80 per cent of the fuel volume of the critical assembly with the same atomic densities, the same geometrical form, and an additional 1-in. water reflector. Critical and safe dimensions are calculated for one storage and two mixing containers. Neutron–hydrogen scattering is treated in Transport- and in P1-approximation. Author (NSA)

N71-27180# Argonne National Lab., Ill. Chemical Engineering Div.
PYROCHEMICAL PROCESSING OF FUEL MATERIALS AND SCRAP CONTAINING 238
P. A. Nelson, J. Fischer, J. F. Lenc, J. R. Haley, and J. D. Schilb Jul. 1970 49 p refs
(Contract W-31-109-eng-38)
(ANL-7709) Avail: NTIS

The use of pyrochemical processing techniques was investigated as a means of recovering Pu-238 from various types of materials and purifying it. One promising process tested consisted of reducing Pu(238)O2 powder or microspheres with liquid Zn–Mg alloys in the presence of a molten chloride salt. A metallic Pu-238 product was then recovered by vacuum distillation of the solvent metals. This process was effective in removing the light element impurities that cause neutron emission by (alpha,n) reactions. Processes were also considered for (1) removing corrosion-product impurities from Pu(238)O2 and (2) recovering Pu-238 from Pu(238O2–Mo and Pu(238)O2–ZrO2 fuel materials. Experiments with Pu-239)02 indicated the general feasibility of pyrochemical processes for these applications, but the procedures have not been sufficiently developed for use in production. Author (NSA)

N71-27201# Oak Ridge National Lab., Tenn.
THORIUM FUEL CYCLE DEVELOPMENT Status and Progress Report, 1 Jan. 1969–31 Mar. 1970
R. G. Wymer and A. L. Lotts, comps. Feb. 1971 108 p refs
(Contract W-7405-eng-26)
(ORNL-4629) Avail: NTIS

Expansions of the uranium-233 storage facility are outlined. Improvements in the in-cell fire protection, emergency power, cell outlet filter, and waste systems for nuclear fuel cells are described. Sol-gel procedures and equipment for the remote preparation of thoria, urania, and plutonia are summarized for recycle test elements. A description if given of the equipment developed for the remote transfer, shape separation, screening, and blending of fuel particles as well as for the determination of particle coating anisotropy, density, and size distribution. Preparations and capsule design for accelerated testing of coated-particle fuels are included along with a summary of sol-gel experiments. J.M.

N71-27223# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
IN PILE ARRANGEMENT FOR STRAIN MEASUREMENTS IN NUCLEAR FUEL AND STRUCTURAL MATERIALS [IN PILE-EINRICHTUNGEN FUER DEHNUNGSMESSUNGEN AN KERNBRENNSTOFFEN UND STRUKTURMATERIALIEN]
H. Will Oct. 1970 32 p refs In GERMAN; ENGLISH summary
(KFK-1281) Avail: AEC Depository Libraries

The design criteria of a creep capsule are presented. The possible methods of measurement for in-pile expansion measurements are discussed in detail with respect to suitability and applicability in an irradiation rig. A description of finished models of irradiation rigs is included. Author (NSA)

N71-27224# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Radiochemie.
EMISSION SPECTROSCOPIC DETERMINATION OF TRACES IN NUCLEAR FUEL MATERIALS [EMISSIONSSPEKTROSKOPISCHE SPURENBESTIMMUNGEN IN KERNBRENNSTOFFEN]
E. Mainka and H. G. Mueller Aug. 1970 34 p refs In GERMAN; ENGLISH summary
(KFK-1281) Avail: AEC Depository Libraries

Two quantitative analytical methods using emission spectroscopy are described. These methods are applied on a routine basis for acceptance controls of plutonium bearing nuclear fuels. Up to 17 trace impurities can be determined in a single analytical run. To minimize spectral interferences, separation between matrix and impurities is needed. Separation is achieved by ion exchange on the one hand and by preevaporation on the other. As a result, the detection efficiencies were significantly increased for most trace elements as compared to the direct methods. Attention was given to the preparation of standard samples. It can be demonstrated that it was possible to use commercially available U3O8 standard samples Nr. 95(1-7) for the determination of impurities. Author (NSA)

N71-27225# Kernforschungsanlage, Juelich (West Germany). Zentral Inst. fuer Angewandte Mathematik.
MATHEMATICAL TREATMENT OF THE STATIONARY THERMAL CONDUCTIVITY IN PIECEMEAL HOMOGENEOUS MEDIA [ZUR MATHEMATISCHEN BEHANDLUNG DER STATIONAEREN WAERMELEITUNG IN STUECKWEISE HOMOGENEN MEDIEN]
Georg Karl Heinrich Walther (Ph.D. Thesis – Tech. Hochschule Aachen, West Ger.) Apr. 1970 64 p refs In GERMAN
(JUL-657-MA) Avail: AEC Depository Libraries

Problems of stationary thermal conductivity in piecemeal homogeneous media arising in the optimum thermal design of the pebble bed reactor are considered. The theory of the solution of the Laplace differential equation with transition conditions is discussed. The theory is generalized and the principles of numerical methods are developed. The numerical methods are then described. The heat conductivity processes in the pebblebed reactor are discussed and treated with the help of the special numerical methods. Author (NSA)

N71-27248# Junta de Energia Nuclear, Sacavem (Portugal). Lab. de Fisica e Engenharia Nucleares.
EXPERIMENTAL STUDY OF THE KINETICS AND DYNAMICS OF CRITICAL ASSEMBLIES FOR THERMAL NEUTRONS [ETUDE EXPERIMENTALE DE LA CINETIQUE ET DE LA DYNAMIQUE D'ASSEMBLAGES CRITIQUES A NEUTRONS THERMIQUES]
Jaime M. Costa Oliveira (Ph.D. Thesis – Paris Univ.) 1969 171 p refs In FRENCH
(LFEN-109-B) Avail: AEC Depository Libraries

The various experimental methods used for the study of the kinetic and dynamic behavior of reactors are outlined and classified as active or passive. The results obtained by the use of one active method, reactivity modulation, and two passive methods, Rossi alpha method and correlation method are described with emphasis on the conditions of application of each method and the precision obtainable. The experimental values are compared with theoretical values and a critical analysis is made of the three methods. It was established that spatial effects play a large role in the dynamics of reactors and that the point model is not always sufficient to interpret the results. The usefulness of the cross correlation method was experimentally proven. The importance of statistical methods for the experimental study of reactors, particularly power reactors, was emphasized. NSA

N71-27258# Atomic Energy Establishment, Winfrith (England).
MEASUREMENT OF THE CALIBRATION FACTOR P(epsilon,

t) FOR FAST FISSION RATIO MEASUREMENTS IN MK. 3 GAS COOLED REACTOR FUEL ELEMENTS

W. H. Taylor and D. De Lapparent (CEA, Cadarache, France) Jan. 1970 13 p refs

(AEEW-M-975) Avail: AEC Depository Libraries

The calibration factor P(epsilon, t), (which has previously been used to convert the ratio of fission product gamma-ray activity, induced in circular foils containing U-238 and U-235, to a fission rate ratio) has been remeasured using foils, shaped as a sector of an annulus, which will be used to determine the fast fission ratio in the annular fuel region of a Mk/3 GCR fuel emenent. Author (NSA)

N71-27260# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

COMPARISON OF DIFFERENT CONCEPTS OF FUSION REACTOR BLANKETS AND THERMODYNAMIC CIRCUITS [VERGLEICH VERSCHIEDENER ENTWUERFE VON REAKTOR MANTEL UND THERMODYNAMISCHEM KREISLAUF]

W. Daenner Jun. 1970 50 p refs In GERMAN; ENGLISH summary

(IPP-4/78) Avail: AEC Depository Libraries

The main tasks of the single blanket zones are pointed out. Based upon some typical blanket concepts, the influence of the vacuum wall, structural material volume fraction, Li-6 concentration, addition of beryllium and/or sodium on the tritium breeding ratio and energy release is outlined. Some remarks about the use of flibe instead of liquid lithium are added with respect at both a separate fusion reactor and a hybrid system. After a short consideration of the radial energy distribution in the blanket, two possible concepts of thermodynamic circuits are contemplated: the liquid metal–steam concept and the direct helium circuit. The advantages and disadvantages of both concepts are confronted, and some basic problems of their development are mentioned. Author (NSA)

N71-27296# Naval Research Lab., Washington, D.C.

IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS Quarterly Progress Report, 1 Nov. 1970–31 Jan. 1971

L. E. Steele, C. Z. Serpan, Jr., H. E. Watson, J. R. Hawthorne, and F. A. Smidt, Jr. 15 Feb. 1971 34 p refs

(Contract AT(49-5)-2110)

(AD-721068; NRL-MR-2214) Avail: NTIS CSCL 18/10

The report, covering research for the period 1 November 1970-31 January 1971, includes: (1) an analysis of the comparative results of various reactor physics codes for predicting the neutron spectrum in a simulated pressure vessel, (2) the fracture resistance of irradiated A533-B steel plate and weld metal as defined by shelf level in dynamic notched impact tests, and (3) results suggesting possible mechanisms of loop growth during damage recovery in vanadium. Author (GRA)

N71-27339# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

SOLUTION OF TWO IMPORTANT PROBLEMS IN THE NUCLEAR INDUSTRY BY FLAME METAL SPRAYING [RESOLUTION DE DEUX PROBLEMES IMPORTANTS DANS L'ENERGIE NUCLEAIRE PAR LA METALLISATION A LA FLAMME]

Armand Faussat 1970 12 p In FRENCH; ENGLISH summary Presented at 6th Intern. Conf. on Metal Spraying, Paris, 14–19 Sep. 1970

(CEA-CONF-1625; Conf-700922-1) Avail: AEC Depository Libraries

Two applications of flame metal spraying were developed to solve specific problems of uranium fuel elements clad with magnesium at Bugey nuclear power station. The spray deposits can be used to decrease the thermal transfer coefficient between uranium and magnesium alloys using an alumina layer and to form metallurgical bonding between uranium and magnesium alloys using an aluminum layer followed by a diffusion heat treatment. The latter application is now used in the fuel element industry. Author (NSA)

N71-27340# Oak Ridge National Lab., Tenn.

STATIC SEALS AND THEIR APPLICATION IN WATER COOLED NUCLEAR REACTOR SYSTEMS

Mar. 1971 69 p refs Prepared by Franklin Inst., Philadelphia

(Contract W-7405-eng-26)

(ORNL-TM-3308) Avail: NTIS

Information relative to six types of static seals commonly used in the primary cooling systems of nuclear reactors is compiled. This information includes a description of each type of seal, its material of construction, design features, operating experience, and advantages and disadvantages. The types covered include spiral-wound asbestos-filled gaskets, hollow metallic O-rings, Belleville spring type of gasketed joints, integrated elastomer and metal retainer gaskets, and solid metal gaskets with heavy cross sections. Omega, canopy, and lip seals are discussed briefly, and information on flange design for gasketing is also presented. Author (NSA)

N71-27359# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.

MODEL INVESTIGATIONS ON CONICAL FLUIDIZED BEDS. A REPORT ON COATING OF FUEL PARTICLES [MODELLUNTERSUCHUNGEN AN KONISCHEN FLIESSBETTEN. EIN BEITRAG ZUR BESCHICHTUNG VON KERNBRENNSTOFFTEILCHEN]

Carl-Friedrich Wallroth (Ph.D. Thesis – Tech. Hochschule, Aachen) Jul. 1970 173 p refs In GERMAN

(JUL-669-RW) Avail: AEC Depository Libraries

For knowledge of the processes, which occur in the coating in conical fluidized beds, the effect of the gas current and gas distribution, the particle load, and the bed and nozzle geometry on the particle motion in the model experiment were studied. It was found that three motion forms can be introduced by the gas distribution between the central and ring nozzles. With increasing gas velocity the effect of the particle load on the motion form was decreased. Research on modified nozzle geometry showed that the nozzle output velocities determine the motion form. With large central nozzle surface the spouting motion disappears. Study on various cone slit angles gave for alpha = 30 (grd) the best proportions (stable bubble motion, good circulation of the particles). Studies on various bed dimensions showed that in the 1-inch bed relatively good fluidized beds are produced, in the larger bed geometries however, very inhomogeneous proportions and, therefore, unfavorable coating conditions appeared as a result of the poor particle concentration in the central coating zone. Author (NSA)

N71-27367 Florida Univ., Gainesville.

THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE GRAPHITE PHASE DIAGRAM AND GRAPHITE PROPERTIES IN THE LIQUID CORE NUCLEAR ROCKET PRESSURE-TEMPERATURE RANGE

Hugh Wilroy Woods (Ph.D. Thesis) 1969 118 p

Avail: Univ. Microfilms: Order No. 70-11759

Some of the graphite properties needed in the design of high-temperature, solid or liquid, graphite nuclear reactor cores are determined. The graphite phase diagram solidus-liquidus interface was experimentally measured from the triple point up to 1000 atmospheres pressure. The graphite triple-point temperature measured was 7606 + or – R. The melting temperature increased with pressure until it reached a measured value of 7821 + or – 63 R at 1000 atmospheres pressure. A theoretical model was developed for the graphite thermodynamic functions at high temperatures. The Debye solid graphite characteristic temperature obtained varied from 1470.0 K at one atmosphere pressure to 1473.7 K at 1000 atmospheres pressure, and the liquid graphite characteristic

temperature varied from 546.2 K at 103 atmospheres pressure to 555.5 K at 1000 atmospheres pressure. Dissert. Abstr.

N71-27388# Argonne National Lab., Ill.
INFLUENCE OF A PREDOMINANTLY OXIDE FUEL LOADING ON THE DYNAMIC BEHAVIOR OF EBR-2
A. V. Campise Oct. 1970 90 p refs
(Contract W-31-109-eng-38)
(ANL-7673) Avail: NTIS

The AIROS-2A dynamic-simulation digital code was used to study the behavior of future EBR-2 cores containing predominantly oxide fuel. The response of predominantly oxide cores was considered with and without Doppler feedbacks. The study concludes that the future dynamic behavior of EBR-2 with loadings of predominantly oxide fuel is predictable, safe, and well within the range of operating experience. Author (NSA)

N71-27389# United Kingdom Atomic Energy Authority, Springfields (England). Reactor Group.
SOME LIMITING ASPECTS OF UO2 PERFORMANCE
J. B. Ainscough 29 Sep. 1969 16 p refs
(TRG-1937(S)) Avail: AEC Depository Libraries; HMSO 3s; BIS $0.50

Recent developments in aspects of UO2 behavior such as fission gas release, fission product swelling, and UO2 creep are examined. Fission gas release from UO2 at temperatures below that necessary to cause columnar grain formation, is believed to be at least a two-stage process involving first the movement of single atoms and very small bubbles to grain boundaries, and then the growth and link up of gas bubbles at the boundaries and their ultimate escape to the fuel-can interspace. Both the solid and the gaseous fission products contribute to swelling. The contribution of the first is fairly easily calculated from the fission yields and from a knowledge of the likely chemical form of each fission product, but the extent of the second, being dependent on burn-up, restraint, and temperature is more difficult to assess since it varies along the radius of a fuel pellet. There is good evidence for believing that in addition to the thermal crrep of UO2 there is also an irradiation creep process which is temperature independent but a function of rating. Author (NSA)

N71-27389# WADCO Corp., Richland, Wash. Hanford Engineering Development Lab.
GAS-FLOW METHOD FOR DETECTION OF FAST NEUTRONS IN REACTORS
Donald P. Brown, Joseph W. Upton, Jr., and Ward G. Spear 6 Oct. 1970 14 p refs Presented at the Am. Nucl. Soc. Winter Meeting, Washington, D.C., 15–19 Nov. 1970
(Contracts AT(45-1)-1830; AT(45-1)-2170)
(WHAN-SA-73; Conf-701102-8) Avail: NTIS

A developmental sensor for fast neutrons which eliminates electrical cable problems and which can operate at temperatures up to 1200 F is described. Based on the Be-9(nuetron,alpha)He-6 reaction, the method uses a flowing gas (helium) to carry the resulting beta emitter from an in-core sensor to a measurement cell external to the reactor. Theoretical considerations of the overall system performance show the sensitivity to be a function of several factors including the He-6 escape probability from the screens, gas-flow rate through the detection cell, He-6 collection efficiency of the fill gas, and temperature. Temperature affects the sensitivity and reduces the transit time of He-6 atoms (0.8 second half life); thus, more atoms enter the measurement cell due to fewer decaying enroute. Author (NSA)

N71-27390# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
STUDY OF TWO CONTROL SCHEMES WITH DYNAMIC CONSTRAINTS ON A MULTIVARIABLE NONLINEAR SYSTEM [ETUDE DE DEUX REGULATIONS AVEC CONTRAINTES DYNAMIQUES SUR UN PROCESSUS NON LINEAIRE MULTIVARIABLE]
Alain Tomei (Ph.D. Thesis–Aix-Marseille Univ., 1969) May 1970 85 p refs In FRENCH
(CEA-R-3988) Avail: AEC Depository Libraries

A study was made on a hybrid computer of two control schemes, operating on a multivariable, nonlinear system with respect to dynamic constraints. The multivariable system chosen is a nuclear reactor with its heat exchangers. The dynamic constraints operate on the input and output temperature derivatives of the cooling fluid in the reactor. These control schemes are used to change the reactor power or the input temperature of the coolant with respect to dynamic constraints. After a theoretical study of the control schemes, a more complete study was carried out on a hybrid computer. Author (NSA)

N71-27391# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoi Energii.
MULTIGROUP DESIGN OF UNIDIMENSIONAL NUCLEAR REACTORS WITHOUT USE OF GRID METHOD [MNOGOGRUPPOVOI RASCHET ODNOMERNYKH YADERNYKH REAKTOROV BEZ ISPOLZOVANIYA METODA SETOK]
E. S. Gluchkov, N. N. Ponomarev-Stepnoi, and N. A. Petushkova 1969 40 p refs In RUSSIAN
(IAE-1938) Avail: AEC Depository Libraries

A technique is presented for solving unidimensional multigroup reactor equations, based on an analytical solution to the diffusion type of equations with the right-hand part being known. On the basis of this procedure, an algorithm (subroutine) was developed and the formulas and relationships needed for the calculation were written. A block diagram for the computer program is given. Results are adduced for the calculations based on the given technique as compared with the results obtained from the calculations using the grid method; the results shown substantiate the effectiveness of the method proposed. Author (NSA)

N71-27567# DuPont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
SAVANNAH RIVER LABORATORY COBALT 60 POWER HEAT SOURCES Quarterly Progress Report, Jul.–Sep. 1970
C. L. Angerman and C. P. Ross, comps. Dec. 1970 27 p refs
(Contract AT(07-2)-1)
(DP-1254) Avail: NTIS

Activities are reported on studies to provide data that will be required for designing, fabricating, and operating Co-60 heat sources. Primary emphasis is on selecting materials for encapsulating cobalt fuel forms and establishing temperature limits for operation of capsules in normal and accident environments. Satisfactory capsule performance was demonstrated through 20,000 hr at 1000 C with Haynes 25, Hastelloy C, and Hastelloy X capsules. Nine of ten superalloy capsules containing irradiated cobalt were heated for up to 10,000 hr at 1000 C and were found intact as measured by helium leak tests; the Hastelloy C capsule heated 10,000 hr had an indicated leak rate greater than that of the other capsules. Oxidation data obtained after 3000 hr at 1000 and 1125 C on capsule and core materials for the WANL 30 kW(t) demonstration unit indicated that radial gaps between fuel pin and Nickel 201 core should be greater than 0.050 in. to prevent interference during five years of operation at normal conditions. The oxide scale formed on Haynes 188 impeded reaction with Nickel 200 at 1125 C for only about 1000 hr. Author (NSA)

N71-27572# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PACIFIC NORTHWEST LABORATORY DIVISION OF ISOTOPE DEVELOPMENT PROGRAMS Quarterly Report, Aug.–Oct. 1970
J. E. Hansen, comp. Nov. 1970 41 p refs

(Contract AT(45-1)-1830)
(BNWL-1308-4) Avail: NTIS

Results of research conducted to develop isotopic fuels are reported. Information is included on progress in programs on waste Cs radiation sources, properties of fission product Rh and Pd, properties of purified fission product Xe, recovery of fission product Cs and Sr, nondestructive testing of radiation sources, advanced source development, circulatory support heat sources, and methods for seabed mineral exploration. NSA

N71-27588# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

PROBLEMS IN THE PRODUCTION OF LARGE VOLUME MAGNETIC FIELDS FOR FUSION REACTORS [PROBLEME DER ERZEUGUNG GROSSVOLUMIGER MAGNETFELDER FUER FUSIONSREAKTOREN]

W. Kafka Mar. 1970 29 p In GERMAN; ENGLISH summary
(IPP-4/70) Avail: AEC Depository Libraries

The production of high magnetic fields in large volumes is studied for a toroidal configuration with a field volume of 1000 cu m, maximum magnetic field of 100 kOe, and an energy content of 10 to the 10th power J. It is investigated whether the prime and operating costs can be appreciably reduced by using a superconducting winding. It is suggested that a cable made of Nb–Ti strands insulated with loose braiding and surrounded by an aluminum alloy sheath extruded around the cable be used as superconductor for about 10 kA. The strands themselves are twisted bundled conductors with high purity copper matrix. Inside the sheath they are in direct contact with the coolant, which is supercritical helium either in liquid form or cooled to about 4.5 K. A small part of the magnetic forces is absorbed by the conductor cable, a large part by the sheath, and the rest by an armature wound on the winding under tension. In this type of conductor the extraction of energy is encouraged by the fact that a longitudinal flow of heated coolant quickly propagates the quench over a coil section. Author (NSA)

N71-27589# Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Fuel Div.

SAXTON CORE 2 FUEL PERFORMANCE EVALUATION. PART 2: EVALUATION OF MASS SPECTROMETRIC AND RADIOCHEMICAL ANALYSES OF IRRADIATED SAXTON PLUTONIUM FUEL

R. J. Nodvik Ju. 1970 144 p refs
(Contract AT(30-1)-3385)
(WCAP-3385-56-Pt-2) Avail: NTIS

Physics evaluations were performed with mass spectrometric, alpha spectrometric, and radiochemical data obtained from analysis of 47 samples (including 10 radial microsamples) removed from Saxton Core 2 Zr-clad PuO_2–UO_2 fuel rods. These rods consisted of both pelletized and vibratory compacted fuel and represented both asymptotic and nonasymptotic neutron spectra. The maximum measured values of axial samples (one-inch segments) and rod-average burnup were about 29,000 and 20,700 MWD/MTM, respectively. Comparisons of burnup values determined with two independent methods, the Heavy Element method and the Nd-148 fission product method, showed agreement to within two percent, thus verifying the internal consistency of the mass spectrometric data and the validity of the data-reduction methods. Author (NSA)

N71-27590# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centres d'Etudes Nucleaires.

STUDY OF THE VALIDITY OF THE SABINE CODE IN CALCULATIONS ON THE SHIELDING OF HEAVY AND LIGHT WATER REACTORS [ETUDE DE LA VALIDITE DU CODE SABINE POUR LE CALCUL DES PROTECTIONS DES REACTEURS A EAU LOURDE ET LEGERE]

Jean-Yves Guezenec, Michel Hot, and Pierre Pepin Oct. 1970 31 p refs In FRENCH
(CEA-N-1354) Avail: AEC Depository Libraries

A test of the SABINE program for the determination of neutron fluxes in iron–water lamellar shields is discussed. A preliminary study using the NIOBE code determined the boundary conditions which were to be introduced into the SABINE program. Author (NSA)

N71-27591# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centres d'Etudes Nucleaires.

PARTIAL MELTING OF LOW DENSITY MIXED OXIDE (U, Pu)O2 AT THE BEGINNING OF IRRADIATION. IN-PILE DISTRIBUTION OF THE FUSED OXIDE [FUSION PARTIELLE DE L-OXYDE MIXTE (UPU)O2 DE FAIBLE DENSITE EN DEBUT D'IRRADIATION. REDISTRIBUTION EN PILE DE L'OXYDE FONDU] ADELEINE CONTE, JACQUES LECLERE, ANDRE LHERMENIER, AND HUBERT MIKAILOFF

Adeleine Conte, Jacques Leclere, Andre Lhermenier, and Hubert Mikailoff 1970 21 p refs In FRENCH Presented at the Intern. Meeting on Fast Reactor Fuel and Fuel Elements, Karlsruhe, West Ger., 28–30 Sep. 1970
(CEA-CONF-1659; CONF-700920-3) Avail: AEC Depository Libraries

During irradiation of mixed oxide UO_2–PuO_2 containing 15 to 20 percent of PuO_2, neutrographic examination shows the formation of a regularly shaped central hole during the first power rise at temperatures above 1950 C but below the melting point. The diameter of the hole becomes very irregular when the fuel core temperature reaches melting point, and two or three concentric zones of different structures are observed. Two experiments are described in which the displacement of matter was followed at the time of partial melting of the fuel and in the course of irradiation (rearrangement of the central hole). It was observed that the radial distribution of fission products is affected by the presence of a fused zone, and that maintenance of high temperature in the zones filled by the flow of molten oxide leads to a fast rearrangement of matter along the central hole. This rearrangement implies the transfer of some of the oxide. It was accepted that this transfer took place through the vapor phase. NSA

N71-27631# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.

RESULTS OF ERROR ANALYSIS FOR IN PILE THERMAL CONDUCTIVITY MEASUREMENT USING THE BALANCED OSCILLATOR TECHNIQUES

W. Daenner [1970] 45 p refs Transl. into ENGLISH from the German Report
(EURFNR-755; KFK-1140) Avail: NTIS

With respect to the in-pile application of the balanced oscillator method for measuring the fuel thermal conductivity and the gap conductance, a detailed error analysis was performed. Observing the postulated optimal test conditions the thermal conductivity could be obtained with a precision of about 15 to 20%, the gap conductance with about 20 to 40% during the entire burnup of the specimen. Necessary improvements of the test loop instrumentation and essential experiments are advised. Some experimental problems with the measurements in the FR2 are discussed. Author (NSA)

N71-27681# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.

OXYGEN/METAL RATIO EFFECTS IN (U,Pu)O2 FUELS

Alan T. Jeffs Aug. 1970 18 p refs Presented at 4th Intern. Conf. on Plutonium and Other Actinides, Sante Fe, N.Mex., 6–9 Oct. 1970
(AECL-3690; CONF-701001-16) Avail: AEC Depository Libraries

A test is described in which six (U,Pu)O2 fuel elements were irradiated with oxygen-metal ratios in the range 1.99 to 2.04. Post-irradiation examination results are presented and discussed in terms of the effects of temperature gradient on oxygen redistribution

in the fuel and the effects of oxygen-metal ratio on fission product gas release and structural alterations. The major effect noted was on gas release which was an order of magnitude greater for (U,Pu)O sub 2.04 than for (U,Pu)O sub 2.00. Oxygen was found to move up the thermal gradient in hyperstoichiometric specimens. Author (NSA)

N71-27683# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
REACTOR HIFAR: THE CONTROL ARM CIRCUITS
W. J. Sinclair May 1970 32 p
(AAEC/M-10) Avail: AEC Depository Libraries

The operation of the control arm circuits in the HIFAR reactor and their relation to other control and safety circuits are described. A description is given of lifting magnet circuits, power supply, operation, master gearbox and control arm position interlocks, downward drive, misalignment transmission system, maintenance, and drop testing. NSA

N71-27684# Commissariat a l'Energie Atomique, Saclay (France).
EL 600: FUEL MANAGEMENT STUDIES
Marcel Charbrillac, Stephen Goldstein, Roger Naudet, and Petr Sulc Oct. 1970 39 p refs In FRENCH
(CEA-N-1379) Avail: AEC Depository Libraries

The fuel flow in the horizontal channels is of the bidirectional push-through type. The initial loading and the fuel management strategy are defined. It is possible to achieve good economy conditions for the first loading utilization and to retain during the transient period a good flattening of the power distribution. The arrangement of depleted fuel elements in the first loading, the number and nature of the recycles, and the dates of the first loadings are studied. Solutions corresponding to the loading of 13 elements by channel are compared to those with 12 elements by channel, as well as simultaneous unloading of a number of elements greater than 2. The strategy being chosen, the management is simulated with the tricycle code, in order to define the actual dates of the successive loadings and the fluctuations of the power map. Author (NSA)

N71-27685# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.
A TECHNIQUE FOR THE PREPARATION OF THIN FILMS FOR TRANSMISSION ELECTRON MICROSCOPY FROM HIGHLY IRRADIATED URANIUM DIOXIDE FUEL ELEMENTS
J. E. Bainbridge Sep. 1970 13 p refs
(AERE-R-5677) Avail: AEC Depository Libraries

Techniques have been developed for the preparation of thin films suitable for transmission electron microscopy from highly irradiated, cracked uranium dioxide fuel elements. The essential feature of the various stages of the technique (impregnation, slicing, trepanning and thinning) is that the number and complexity of the handling operations are reduced to a minimum. In the thinning operation this is achieved by electropolishing with a reversible polarity double jet electrolyte process which eliminates the need for mechanical contact. Author (NSA)

N71-27739# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
USE OF DIGITAL ON LINE COMPUTER FOR NUCLEAR REACTOR PHYSICS EXPERIMENTS [USO DI UN CALCOLATORE DIGITALE ON LINE PER ESPERIENZE DI FISICA DEI REATTORI NUCLEARI]
T. Ferrari, R. Martinelli, N. Pacilio, and V. Valent 25 Mar. 1970 72 p refs In ITALIAN
(RT/FI-(70)16) Avail: AEC Depository Libraries

The use of a small digital computer (PDP-8, 12-bit word, 4K-word memory) for on-line data collection and reduction, analysis, and control of some critical facilities at C.S.N. Casaccia is described in five reactor-physics procedures. They concern: (1) relative measurements of absorption cross-sections via oscillating samples; (2) statistical analysis of nuclear particle detection processes; (3) reactor-noise time-analysis methods for prompted-neutron lifetime and reactivity measurements in reactor systems; (4) pulsed-neutron experiments; and (5) stable-period experimental determination. Author (NSA)

N71-27740# Japan Atomic Energy Research Inst., Tokyo.
ANALYSIS OF FAST CRITICAL EXPERIMENTS AND A REVISION OF THE JAERI-FAST SET
Hideki Takano, Akira Hasegawa, and Satoru Katsuragi Feb. 1971 68 p refs In JAPANESE
(JAERI-Memo-4215) Avail: AEC Depository Libraries

The standard critical assemblies were analyzed using the Japan Atomic Energy Research Inst. JAERI-Fast Set. The integral quantities analyzed are effective multiplication factors, spectral indices, material worths, and perturbation cross sections. Problems involved in various group constants of the set were examined. Revisions of the set were made according to the above examination. It is concluded that the revised JAERI-Fast Set can be applied for analyses of experiments as well as design studies. Author (NSA)

N71-27741# European Nuclear Energy Agency, Paris (France).
REPORTS ON JOINT UNDERTAKINGS AND COMMON SERVICES, NUCLEAR POWER, SCIENTIFIC AND TECHNICAL COOPERATION, HEALTH AND SAFETY, AND LEGAL AFFAIRS Activity Report, Nov. 1970
1970 117 p refs
(NP-18600) Avail: AEC Depository Libraries

A review of activities for European Nuclear Energy Agency during 1970 is presented. Activities are discussed under the following main headings: joint undertakings and common services; nuclear power; scientific and technical cooperation; health and safety; and legal affairs. NSA

N71-27881# Japan Atomic Energy Research Inst., Tokyo.
CORE TEMPERATURE ANALYSES FOR LOSS-OF-COOLANT ACCIDENTS OF LIGHT WATER REACTOR BY THE COMPUTER CODE NURLOC-1.0
S. Mitake, T. Nogaito, H. Hatta, T. Nabeta, A. Fukuda et al Nov. 1970 126 p refs In JAPANESE
(JAERI-4194) Avail: AEC Depository Libraries

Results of accident analyses for a commercial power reactor by the digital computer program NURLOC-1.0, which was developed to show thermal conditions of a reactor core under a loss-of-coolant accident, are described. By these analyses, some features of the code are also made clear. The following information was obtained: (1) In the course of an accident, some portion of the core melts. Heat to cause melting is supplied mainly by the metal-water reaction. (2) Metal-water reaction is controlled strongly by the steam generation rate. (3) It takes a great deal of computational time to simulate an accident for a whole core which includes structures such as core support grids or plate. Author (NSA)

N71-27848# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
MICROWAVE TECHNIQUE FOR MEASUREMENT OF HIGH TEMPERATURE AND NEUTRON FLUX IN NUCLEAR REACTORS [METODI DI MISURA DI ALTE TEMPERATURE E DI FLUSSI NEUTRONICI IN REATTORI NUCLEARI MEDIANTE TECHNICHE DI MICROONDE]
C. Rosatelli (CNEN) 22 Jan. 1970 32 p refs In ITALIAN
(RT/FI-(70)7) Avail: AEC Depository Libraries

A brief survey of the microwave technique application to temperature and neutron flux measurements within nuclear reactors is given. Some results of a preliminary study carried out at the computing center are illustrated. Further developments in the field of the instrumentation for nuclear reactors are suggested. Author (NSA)

N71-27849# Institutt for Atomenergi, Kjeller (Norway).
CHEMICAL ANALYSIS OF HIGH BURN-UP PuO2 FUEL 1: METHODS
K. Joon, R. den Boef, J. Haaland, D. E. Stijfhoorn, and R. de Wit Jun. 1970 25 p refs
(KR-140) Avail: AEC Depository Libraries

A scheme is described for chemical isolation and purification of Zr, Mo, Ru, Pd, Cs, Nd, Pm, Sm, Eu, and Pu from irradiated pyrocarbon-silicon carbide-coated PuO2 fuel. The final analysis is done by isotopic dilution mass spectrometry, except in the case of Pm, which is determined by liquid scintillation counting, using the Pm-149, spike and gamma spectrometry for chemical yield determination. The scheme can also be applied for other types of nuclear fuel, and it can easily be extended to comprise other elements as well. Author (NSA)

N71-27850# Japan Atomic Energy Research Inst., Tokyo.
ANALYSIS OF FLUX MEASUREMENT NEAR STRONG ABSORBER USING VISTA METHOD. 1
Eiji Takeuchi, Masayuki Akimoto, and Renzo Takedo Dec. 1970 35 p refs In JAPANESE; ENGLISH summary
(JAERI-4238) Avail: AEC Depository Libraries

Using the VISTA method, strong absorber experiments were carried out at SHE reactor. Analytical results of neutron flux distribution near the strong absorber are described. The analyses are based on the one dimensional S sub n transport theory and are done by taking into account flux perturbation due to the presence of foils in the system to be measured. Agreement between experiment and calculation is very good. On the other hand, in the JPDR-II cruciformed control rod design, the boundary condition was obtained using the S sub n transport theory computer code in multigroups. Author (NSA)

N71-27851# Eidgenoessisches Institut fuer Reaktorforschung, Wuerenlingen (Switzerland).
CORONA: A PROGRAM FOR TWO GROUP CONTROL ROD CALCULATIONS IN A REFLECTED REACTOR
T. Juillerat, P. Koehler, and C. Lerch May 1970 27 p refs
(EIR-166) Avail: AEC Depository Libraries

CORONA (Control Rod Analysis) calculates the effective multiplication constant and two group fluxes in a cylindrical reactor with fully or partially inserted control rods. The fuel lattice, which must be homogenized, may be surrounded by a radial reflector. Material properties in the axial direction are assumed constant. No control rods are allowed in the reflector. The method of solution is based on the heterogeneous theory with diffusion theory being used in core and reflector. Boundary conditions at control rod surfaces make use of effective extrapolation lengths which must be supplied to the program as input parameters. The theory on which the program is based is outlined and ALGOL and FORTRAN input schemes are described. A sample output is presented. Author (NSA)

N71-27852# Army Engineer Reactors Group, Fort Belvoir, Va. Engineering Div.
THE THEORETICAL NUCLEAR ANALYSIS OF THE MH-1A: CORES 2 AND 3 Final Report
Michael V. Gregory, Shrinivas S. Iyer, Richard A. Lillie, and C. Daniel Henry 1 Mar. 1971 112 p refs
(AD-721019; ED-7102) Avail: NTIS CSCL 18/11

The report presents the methods and results of the theoretical analysis of the nuclear properties of MH-1A Cores 2 and 3. The basic physical parameters are obtained by use of two cross-section codes, LEOPARD and LEOPROD, an X-Y geometry depletion code TURBO*, plus a Z-axial calculation using the CNCR-2 code together with the HOMOG and PEAK processor codes. The theory, results, and input details of the LEOPROD blackness theory code giving absorber region constants are considered in some detail. Author (GRA)

N71-27853# Commissariat a l'Energie Atomique, Grenoble (France). Centres d'Etudes Nucleaires.
STATISTICAL INTERPRETATION OF UNCERTAINTY COEFFICIENTS IN THERMAL CALCULATIONS FOR NUCLEAR REACTORS. PARTICULAR PROBLEMS IN THE APPLICATION OF THE SIGMA METHOD. APPLICATION TO REDISTRIBUTION OF THE FLOW [INTERPRETATION STATISTIQUE DES COEFFICIENTS D'INCERTITUDE DANS LE CALCUL THERMIQUE DES REACTEURS NUCLEAIRES. PROBLEMES PARTICULIERS D'APPLICATION DE LA METHODE DES SIGMA. APPLICATION AU CALCUL DE LA REDISTRIBUTION DE DEBIT]
Serge Fabrega Oct. 1970 69 p refs In FRENCH
(CEA-R-3895) Avail: AEC Depository Libraries

Various statistical methods for taking into account the uncertainties involved in calculations on the thermal characteristics of nuclear reactors are described. The variance addition theorem is currently used for calculating the probabilities of thermal accidents in reactors. It is shown that the use of this method can be extended if certain elementary variances are replaced by different calculated values. It is found, for example, that it is necessary to divide the local heat flux peaks by a factor of the order of 2, in order to take into account: the limited amplitude of the flux peak, the random position of the flux peak, the nonlinearities, and the existence of threshold values. The same reduction is applicable to the velocity effect occurring in the local air gap in the hot channel. Author (NSA)

N71-27855*# Aerojet-General Corp., Azusa, Calif.
THERMAL DESIGN OF THE SNAP 8 TANTALUM STAINLESS STEEL BOILER
A. J. Sellers Jun. 1971 105 p refs
(Contract NAS3-13458)
(NASA-CR-72780) Avail: NTIS CSCL 18N

The design analysis of a once through type, forced convection mercury boiler is presented. Heat and momentum transfer parameters are established as well as the internal geometry of the working fluid flow passage and overall boiler design configuration. The boiler design was based on heat and momentum transfer correlations derived from idealized wetting and non-wetting two phase flow models. Predicted performance characteristics as defined by NaK and mercury-side temperature and pressure profiles were in relatively good agreement with test results of experimental and full scale boilers. If foreign materials such as oil or air enter the system, undesirable changes in heat transfer result. Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N71-28823# Air Force Cambridge Research Labs., Bedford, Mass.
DIELECTRIC MATTER AND THE VECTOR D
Leonard J. Eyges 5 Oct. 1970 27 p refs
(AD-721181; AFCRL-70-0537; AFCRL-PSRP-428) Avail: NTIS CSCL 20/3

This is the first of two papers in which an attempt is made to clarify the standard theories of dielectrics and of permeable materials, and in particular, to clarify the meanings of D and H, two vectors that are frequently defined unsatisfactorily in the literature. It is intended to introduce certain well-defined postulates, and then to show that these postulates are equivalent to the implicit and sometimes camouflaged assumptions that underlie the usual treatments. This first article treats dielectrics and D; a later one will treat permeable matter and H. Author (GRA)

N71-26828*# Poritsky (H.), Schenectady, N.Y.
MICROSLIP AND CREEP IN CONTACTS
H. Poritsky *In* NASA. Washington Interdisciplinary Approach to the Lubrication of Concentrated Contacts 1970 p 77-152 refs
(See N71-26826 15-15)
Avail: SOD $2.50 NTIS HC$6.00/MF$0.95 CSCL 20K

A detailed discussion of microslip and creep phenomena for stationary and rolling contacts of cylindrical bodies is presented with emphasis on the method of conformal mapping in the solution for the pertinent harmonic functions. Microslip and creep over Hertzian contact ellipses for noncylindrical bodies and some of the approximate analytical solutions and experimental measurements are reported. The analytical solutions of Hertz and Mindlin emphasizing the analogies to classical problems in potential theory, as well as the more recent analytical solutions by de Pater, Kalker, and Mow et al are reviewed. Numerical methods of solution of the contact problems are considered and the method of integral equations for the tractions over the contact area is emphasized. Author

N71-26887# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Sukumi (USSR). Fiziko-Tekhnicheskii Inst.
ELECTRIC FIELD IN TOROIDAL METALLIC CHAMBER WITH SECTIONS
M. A. Stotland and Sh. V. Khil 1970 20 p refs In RUSSIAN
(NP-18505) Avail: AEC Depository Libraries

A quasi-stationary approximation was developed for an electric field in a toroidal metallic chamber with meridional sections and equatorial plane sections designed for the penetration of an induction electric field. Equations were also obtained for the electric field outside of the current carrying surface of the toroidal loop with meridional cross sections. Author (NSA)

N71-27060# European Space Research Inst., Frascati (Italy).
A METHOD FOR THE DETERMINATION OF ANTENNA ADMITTANCE IN ANISOTROPIC MEDIA
T. A. Hall 1970 6 p refs
Avail: NTIS

Spherical and dipole probes are used in the lower ionosphere for measuring electron densities and their use can be extended into upper ionosphere and inner magnetosphere studies. Several problems are encountered, one being the effect of large Debye lengths which means that probes can no longer be considered as isolated from other parts of the spacecraft. A general method is presented by which the admittance may be found under these conditions; also calculations of the admittance of a dumbell probe are presented as an example. The method consists of finding the charge distribution on the surface of the probe. ESRO

N71-27119# Sandia Corp., Albuquerque, N.Mex.
ADHESION THEORY REVIEW AND CRITIQUE
Nicholas J. De Lollis Dec. 1970 31 p refs Sponsored by AEC
(SC-RR-70-915) Avail: NTIS

The present theories of adhesion are reviewed, and the concept of a bond failure mechanism caused by water desorption is introduced. Recent work in support of the mechanism of bond failure by water desorption is discussed. Contributory factors aiding both adhesion and bond failure are described. Author

N71-27139# National Inst. for Research in Nuclear Science, Hilton (England). Rutherford High Energy Lab.
EQUATIONS AND FORMULAE FOR MAGNETS WITH AIR CORED WINDINGS OF SADDLE COIL TYPE
J. H. Coupland Aug. 1970 27 p refs
(RHEL/R-203) Avail: AEC Depository Libraries; HMSO 4s; BIS $0.90

As most of the formulae and the integral rule which are derived and developed in this report are not widely known, it is hoped that this treatment will be useful in accelerator and other laboratories where there is a growing interest in high magnets of the saddle-coil type using superconducting windings. Author (NSA)

N71-27261# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
HIGH FIELD MAGNET FOR A HYDROGEN ARC EXPERIMENT [EIN HOCHFELD MAGNET FUER EIN WASSERSTOFFBOGENEXPERIMENT]
J. D. Becker, H. Lohnert, S. Oswald, and R. Zickart Apr. 1970 33 p In GERMAN; ENGLISH summary
(IPP-4/73) Avail: AEC Depository Libraries

The design, construction, and operation of a 120 kG Bitter-type magnet is described. With a given energy dissipation of 12 MW (60 kA, 320 V, 0.4 sec) the solenoid provides at its center a field of 120 kOe with a useful inside diameter of 10 cm and a length of 85 cm. Five windows for diagnostics are distributed along the length of the coil. Their influence on the field distribution should remain within a limit of 3 percent. The magnet is cooled during the pulse intervals with water or liquid nitrogen. The solenoid consists of a stack of 265 disks made of hard electrolytic copper, thickness 0.4 cm, inside diameter 11 cm, and outside diameter 33 cm. Each disk is fitted around the outer edge with a soldered copper tube (4 x 0.5 mm) through which the cooling medium circulates. Author (NSA)

N71-27262# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
CALCULATION OF THE CURRENT FLOW DIRECTIONS IN A CHANNEL WITH STAGGERED ELECTRODES UNDER MHD GENERATOR CONDITIONS
M. G. Croci, R. Gorenflo, and F. Hertweck Jul. 1970 33 p refs
(IPP-6/89) Avail: AEC Depository Libraries

With suitable simplication it is possible, by complex analysis, to calculate the strength and direction of the electric current flow in MHD generator configurations. In the model described, the electric current forms a plane potential flow for which an explicit expression can be given. Author (NSA)

N71-27300 Johns Hopkins Univ., Baltimore, Md.
BRILLOUIN SCATTERING STUDY OF THE FERROELECTRIC TRANSITION IN KH2PO2
Edward Marx Brody (Ph.D. Thesis) 1969 228 p
Avail: Univ. Microfilms Order No. 70-11778

The measurement and interpretation of the shear acoustic velocity in the vicinity of the ferroelectric phase transition at 122 K of a single crystal of potassium dihydrogen phosphate (KDP) is discussed. The velocity is measured by Brillouin light scattering spectroscopy using a He-Ne gas laser as the light source and a pressure scanned plane Fabry Perot interferometer as the analyzer. The measurements are made from 113 K to 300 K and with electric fields. Two theoretical approaches are employed in interpreting the measured properties. The first approach is to discuss the problem in terms of lattice dynamics. The measured acoustic velocity is considered to result from a mixing of the soft ferroelectric optic model. The second theoretical approach is to consider the possible equilibrium configurations of the protons in the KDP structure. This technique uses statistical mechanics to derive a free energy expression, and culminates in the Silsbee, Uehling, and Schmidt (SUS) equations. Dissert. Abstr.

N71-27371# Northwestern Univ., Evanston, Ill.
QUANTUM THEORY OF MAGNETIC MATERIALS Final Technical Report
Arthur J. Freeman and Donald E. Ellis Feb. 1971 9 p refs
(Grant AF-AFOSR-1706-69)
(AD-720881; AFOSR-TR-71-0339) Avail: NTIS CSCL 20/12

The purpose of this project has been to investigate theoretically

the origin of the magnetism observed in magnetic materials and to obtain a detailed understanding of the unusual magnetic, electric and optical properties of these systems. Quantum theoretical approaches to the study of the electronic properties of magnetic materials and of solids in general have traditionally followed somewhat different views, the localized model and the itinerant model. This research follows the philosophy that a fundamental description of the physics of electrons in solids is found in an approach which lies somewhere in between these two extremes. The results of these theoretical calculations are closely correlated with data obtained from experiments such as Mossbauer effect, NMR, neutron diffraction and Fermi surface studies. The investigations fall into three main areas, studies of the electronic band structure of magnetic materials like the actinide metals and their compounds, studies of covalency and superexchange in antiferromagnetic insulating materials involving 3d transition metal, 4f rare-earth, and 5f actinide metal ions, and development of a tight binding method in order to include into one scheme the principal advantages developed. Author (GRA)

N71-27374# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
STUDY OF SOME PROBLEMS OF CAVITY RESONATORS BY MEANS OF FINITE DIFFERENCES [STUDIO DI ALCUNI PROBLEMI DEI RISUONATORI A CAVITA MEDIANTE DIFFERENZE FINITE]
R. Florean, F. Tazzioli, and G. Verri 11 May 1970 13 p In ITALIAN *Its* Nota Interna No. 473
(LNF-70/17) Avail: AEC Depository Libraries

Equations were solved in the present study by means of finite differences. The solution of the problem is then reduced directly to that of a system of algebraic equations. This method was used to determine the resonance frequency, the merit factor, and the shunt impedance of some resonators. The comparison with the theoretical values from former reports made it possible to determine an order of magnitude of the error. The numerical method, applied by others to the fundamental mode, was extended to higher modes with devices regarding the convergence criterion. The method does not give high precision on the absolute values of the resonance frequency. It does, however, give an approximation of the field configuration and is useful in studying small variations on the form of a given model by varying a certain parameter as for example the resonance frequency of one mode with respect to that of another. Author (NSA)

N71-27375 California Univ., Los Angeles.
THIRD SOUND IN UNSATURATED FILMS OF SUPERFLUID HELIUM
James Cavender Fraser (Ph.D. Thesis) 1969 141 p
Avail: Univ. Microfilms Order No. 70-12008

The velocity of third sound in unsaturated films of superfluid helium was measured at several temperatures between 1.12 K and 2.05 K. Helium films from 4 to over 100 atomic layers were absorbed on glass substrates. The third sound waves were generated thermally. They were detected by sensing the very small temperature oscillations which accompany the hydrodynamic wave. The velocity was measured by the time of flight of sine wave pulses whose frequency ranged from 500 Hz to 5 KHz. The velocity was found to be less than that predicted by Atkins' hydrodynamic theory of third sound in saturated helium films which is based on the thermodynamic properties of the bulk liquid. Atkins' equations were modified to take into account a variation of the thermodynamic properties of the film with thickness. An analysis of the velocity data has yielded the average superfluid density as a function of film thickness. Dissert. Abstr.

N71-27376 Florida Univ., Gainesville.
NONCOLLINEAR PHASE MATCHING EFFECTS IN UNIAXIAL CRYSTALS
Harry Eugene Bates (Ph.D. Thesis) 1969 114 p
Avail: Univ. Microfilms Order No. 70-11733

Equations are developed to describe all possible cases of NPM in uniaxial crystals and to verify experimentally the NPM hypothesis. The wavelength of the light in the NPM cone was found from spectrographic measurements to be the same to within + or − 0.5 Angstroms as that for collinear second harmonic generation. All characteristics of the NPM cones predicted by the hypothesis were found to be in agreement with experiment. Rings produced by the NPM cones were photographed using a Polaroid film plate. The temperature dependence of these rings was studied for the case where the laser beam propagated normal to the optic axis of the crystal. The sine squared of the interior half angle of the NPM cone outside the crystal in this case was found to vary almost linearly with temperature over a large range in accordance with predicted behavior. This result was used to develop a technique for characterizing the phase matching properties of materials. Dissert. Abstr.

N71-27377 Kansas Univ., Lawrence.
TEMPERATURE DEPENDENCE OF THE FERROMAGNETIC RESONANCE LINEWIDTH
Peter Kurt Leichner (Ph.D. Thesis) 1969 128 p
Avail: Univ. Microfilms Order No. 70-11044

A calculation of the temperature dependence of the magnetic resonance linewidth in ferromagnetic crystals is presented. The calculation is based on the Kubo and Tomita relaxation function and the method of moments of Van Vleck, generalized to finite temperatures. The second and fourth moment expressions, calculated directly from the Kubo and Tomita relaxation function, are in agreement with the results of Richards and Anderson and Weiss. Linewidth calculations are made for the two ferromagnets $K_2CuCl_4 \cdot 2H_2O$ and Ni for temperatures ranging from T=0 K to T = 1OT(c). A comparison of the calculated values with experimental measurements is given. It is found that the constant coupling method gives good agreement with experiment, whereas the high density approximation leads to poor results. It is demonstrated that short range correlations are of predominant importance in linewidth calculations. Dissert. Abstr.

N71-27378# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
W-MESHER: A COMPUTER PROGRAM TO ANALYTICALLY PARTITION A TWO DIMENSIONAL FIGURE
M. R. Monkelis Jul. 1970 140 p refs
(WANL-TME-2721) Avail: NTIS

A computer code is described which is used to analytically partition a two dimensional figure, bounded by straight line and circular arc segments, into a network of mesh cells. The output is capable of being used in heat transfer codes to calculate the temperature distribution of a given geometrical configuration with known boundary conditions. Author (NSA)

N71-27438 Clark Univ., Worcester, Mass.
QUADRUPOLE MOMENTS IN GENERAL RELATIVITY AND THEIR INFLUENCE ON PARTICLE MOTION
John Henry Young (Ph.D. Thesis) 1969 41 p
Avail: Univ. Microfilms Order No. 70-11184

The method developed by Erez and Rosen for obtaining exact solutions of the Einstein gravitational field equations for mass distributions having multiple moments is used to derive the first correct statement of the (exterior) metric for a mass distribution possessing a quadrupole moment. The solution is initially obtained in prolate spheroidal coordinates, but is then also expressed in spherical coordinates and expanded in inverse powers of r. The time component of the metric for very large r has the functional behavior characteristics of the Newtonian potential of the mass distribution. Attention is then given to the orbital motion of a particle in this field. This method of solution appears to have validity for the sort of planetary motion observed in the solar system (as

with Mercury, for example) even for a solar quadrupole moment of the size discussed by Dicke. The formula derived for the perihelion precession turn out to be a superposition of the Schwarzschild term and the Newtonian term for the precession in a classical quadrupole field. Dissert. Abstr.

N71-27584 Florida State Univ., Tallahassee. Dept. of Meteorology.
ACOUSTIC WAVE PROPAGATION IN A NON-GRAY RADIATING ATMOSPHERE
John C. Gille *In* WMO Radiation Including Satellite Tech. 1970 p 543–546 refs (See N71-27484 15-13)
(Grant NSF GA-925)
Copyright. Avail: Issuing Activity

A general approach to the radiative transfer effects on acoustic waves suitable to investigate the propagation of long acoustic waves for an atmosphere such as that of Mars, where radiative processes are much more rapid than on earth is presented. ESRO

N71-27585 Brown Univ., Providence, R.I.
AN INVESTIGATION OF MICROWAVE PHONON ATTENUATION IN GERMANIUM AT LOW TEMPERATURES
Juris Kalejs (Ph.D. Thesis) 1969 116 p
Avail: Univ. Microfilms Order No. 70-8740

The attenuation of compressional sound waves in germanium measured as a function of the direction of sound wave propagation at several frequencies between 0.150 and 2.84 GHz in the temperature range 4 to above 100 K. No variation of the attenuation with the direction of propagation was observed below about 60 K. A comparison of experimental results and attenuation theories has been carried out between 10 and 60 K. It is found that the L sub s + L yields L process can account for the magnitude as well as the temperature and frequence dependance of the measured attentuation for <110> and <111> sound wave propagation in this temperature range when certain considerations are taken into account in the evaluation of the attenuation coefficient. The L sub s + L yields L process cannot account for the measured attenuation of a compressional sound wave propagating along a <100> direction. The L sub s + T yields T process is considered as the additional attenuating mechanism for this direction. Dissert. Abstr.

N71-27587 Brown Univ., Providence, R.I.
INFLUENCE OF MAGNETIC INTERACTIONS ON THE de HAAS-VAN ALPHEN
Wayne Cecil Broshar (Ph.D. Thesis) 1969 139 p
Avail: Univ. Microfilms Order No. 70-8696

The oscillatory de Haas-van Alphen magnetization has been studied for silver samples at magnetic fields up to 80 kilogauss and at temperatures from 0.5 to 4.2 K. Under these conditions the amplitude of the oscillatory magnetization becomes the order of the period, in field, of the oscillations. This leads to the observation of effects due to magnetic interaction. For samples of non-zero demagnetizing coefficient this is further modified by the presence, during part of each oscillation, of domains. Measurements were made by various techniques. The thermodynamics of a system in an applied magnetic field is considered in detail. The heating of a partially thermally isolated sample due to eddy currents produced by an audio frequency modulating magnetic field was measured as a function of the modulating frequency and compared to the results predicted for a normal metal of the same geometry and conductivity. Dissert. Abstr.

N71-27633# Technische Universitaet, Brunswick (West Germany). Inst. fuer Hochspannungstechnik.
INVESTIGATIONS ON LOW INDUCTIVE SPARK GAPS FOR HIGH VOLTAGES IN AIR [UNTERSUCHUNGEN AN NIEDERINDUKTIVEN SCHALTFUNKENSTRECKEN FUER HOHE SPANNUNGEN IN LUFT]
M. Pillsticker Oct. 1970 44 p refs In GERMAN; ENGLISH summary
(BMBW-FBK-70-17) Avail: AEC Depository Libraries

Investigations into the development of a low-inductive spark gap (smaller than 10 nH) are reported. The time between the start of trigger pulse and the complete breakdown, as well as the jitter of this time, should not exceed a few nanoseconds. The operating voltages are substantially lower than the static breakdown voltage in excess of 100 kV. The most important parameters for such short times are: energy of the trigger pulse, geometric dimensions of the electrodes, gas pressure in the spark gap, and the voltage across the main electrodes before applying the high-voltage trigger pulse. The investigations revealed that a four-electrode spark gap is the best choice to meet the requirements. Author (NSA)

N71-27643# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
GENERALIZED FOURIER TECHNIQUES FOR THE THEORY OF LIGHT SCATTERING Final Report, 1 Jan. – 31 Dec. 1970
Emil Wolf Jan. 1971 12 p refs
(Contract F19628-70-C-0138)
(AD-720858; AFCRL-71-0114) Avail: NTIS CSCL 20/6

The report presents a review of research carried out under the contract. The work was chiefly concerned with the development of systematic techniques for determining the structure of three-dimensional semi-transparent objects from the measurements of transmission functions of holograms to which these objects give rise when they are illuminated by light beams. Related work was also carried out on some analogous problems involving sound waves rather than light waves and on several problems involving the angular spectral representation of wavefields. The report includes references to all publications reporting results of this research, abstracts of all the publications and list of personnel that assisted with this work. Author (GRA)

N71-27686# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy
EXPERIMENTAL SOLENOID MADE OF Nb3Sn STRIP
N. G. Anishchenko, V. A. Bashilov, V. A. Vasil'ev et al 1970 8 p In RUSSIAN
(JINR-P8-5440) Avail: AEC Depository Libraries

Construction of the solenoid is described and the results of its test are given. The solenoid is made of two disks wound of superconducting Nb3Sn strip 40 mm wide and having an inside diameter of 122 mm. The magnetic field intensity in the center of the solenoid of 30 kG, critical current being 480 A. Author (NSA)

N71-27687# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
MAGNETIC FIELD OF THICK FINITE dc SOLENOIDS
V. I. Danilov and M. Ianovich 1970 26 p In RUSSIAN
(JINR-P9-5441) Avail: AEC Depository Libraries

The expressions of the magnetic components in/or around any thick finite dc solenoid were obtained from the expression of the vector potential of a circular current loop. The field component derivatives with respect to the spatial coordinates were also determined. From these general expressions the field of semi-infinite solenoids with zero inner radius was deduced as a particular case. Author (NSA)

N71-27778# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
EDDY CURRENT LOSS THROUGH PULSED MAGNETIC FIELDS [WIRBELSTROMVERLUSTE DURCH KURZZEITIG VERAENDERLICHE MAGNETFELDER]
B. Oswald 1970 14 p In GERMAN
(IPP-4/80) Avail: AEC Depository Libraries

The eddy-current losses in closed current loops caused by pulsed magnetic fields are calculated. The results may be useful for various applications, such as pulsed magnets, and superconducting coils. Author (NSA)

N71-27779 Texas A&M Univ., College Station.
MATRIX ISOLATION SPECTRA OF CS2 AND SO2
Victor Thomas Jones, III (Ph.D. Thesis) 1969 89 p
Avail: Univ. Microfilms Order No. 70-11551

The 2000A and 2900A absorption regions of SO2 were studied in 1:500 mixtures of neon and 1:300 mixtures of argon at 5.6 K. The argon matrix was also studied at 20 K. Evidence of three independent electronic transitions were found in the 2000A region. These three systems of bands are denoted by alpha sub 1, alpha sub 2 and alpha sub 3 and their shifts in neon relative to the vapor phase are -65, -97, and -81/cm respectively. Only the bands of the alpha sub 2 system could be observed in argon. The alpha sub 1 and alpha sub 3 systems did not appear because of the crystal perturbations. The shift of the alpha sub 2 system in argon was found to depend on an aging process. The observed shifts extrapolated to the origin, were +130 before the aging and +90/cm after aging. In neon, the vibrational energy levels were not affected by matrix perturbations. In argon, the shift was observed to vary with the vibrational energy, indicating that the vibrational frequencies are perturbed. Dissert. Abstr.

N71-27974# Commissariat a l'Energie Atomique, Limeil (France).
CONTRIBUTION TO THE UNDERSTANDING OF THE HIGH MAGNETIC FIELD COMPRESSION PRODUCED BY THE IMPLOSION OF A THIN METAL TUBE [CONTRIBUTION A L'ETUDE DE LA COMPRESSION DE CHAMP MAGNETIQUE INTENSE PAR IMPLOSION D'UN TUBE METALLIQUE]
Jacques Besancon (Ph.D. Thesis - Paris Univ.) Dec. 1970 208 p refs In FRENCH
(CEA-R-4024) Avail: AEC Depository Libraries

The following essential phenomena occurring during a magnetic flux compression obtained by the implosion of a thin conducting liner are presented: acceleration time, dynamic changes, heating and instability behavior of the liner, field diffusion through the conducting walls and the resulting flux losses which control the increasing field in the cavity. Various implosion models are proposed; the most elaborate model leads to the numerical computation of the flux compression. Repeated experiments have led to improvements in the flux injection techniques, the optical and electrical diagnostics, and consequently the final compressed field. Techniques are now available for obtaining and recording reproducible fields of 12 MOe in 0.8-cm-diameter cavities. All the implosions are compared with theoretical predictions. The final phase of the linear turnaround is of particular interest. It is concluded that the electrical conductivity of the liner determines the final flux value. Author (NSA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N71-28811*# Louisiana State Univ., Shreveport.
[HIGH ENERGY NUCLEON-NUCLEON AND PION-NUCLEON COLLISION MODEL FOR NUCLEOR CASCADE] Final Technical Report
Rex L. Matlock [1970] 18 p refs
(Grant NGR-19-012-001)
(NASA-CR-115041) Avail: NTIS CSCL 20H

A model for the description of nucleon-nucleon and pion-nucleon collisions at high energy and incorporation of this model into a complete Monte-Carlo description of a Nucleor Cascade is discussed. The effort in this research was directed toward calculating, based on the Hagedorn model, the momentum and particle number distributions necessary for a Monte-Carlo description of a Nucleor Cascade. The required momentum distributions, for the case of proton-proton collisions, were readily available from Hagedorn's calculations. The momentum distributions for the pion-proton case were worked out by the author in collaboration with Dr. Hagedorn. It is worth noting here that the distributions for the pion-proton case need further experimental verification in order to insure their validity. Author

N71-28845# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Nuetronenphysik und Reaktortechnik.
MODAL DEVELOPMENT OF THE NEUTRON TRANSPORT EQUATION FOR PLANE GEOMETRY [MODALE ENTWICKLUNG DER NEUTRONENTRANSPORTGLEICHUNG FUER EBENE GEOMETRIE]
W. Schwetje (Ph.D. Thesis - Tech. Hochschule, Karlsruhe, West Ger.) Jul. 1970 118 p refs In GERMAN; ENGLISH summary
(KFK-1223) Avail: AEC Depository Libraries

The problem of solving the neutron transport equation is reduced to the problem of solving systems of linear first order differential equations or systems of Fredholm integral equations of the second type with degenerate kernel by four different half range expansions of low order. The expansion functions or modes may be specifically adapted to each problem in both half spaces. Numerical methods are given for solving the reduced systems of equations. It is demonstrated for several representative examples that these expansions - with suitably chosen modes - yield the same accuracy as numerical discrete ordinate methods, but with much less computing time. Author (NSA)

N71-28846# Paris Univ., Orsay (France). Lab. Joliot-Curie de Physique Nucleaire.
ON THE NUCLEOSYNTHESIS OF LITHIUM, BERYLLIUM AND BORON
R. Bernas, E. Gradsztajn, H. Reeves (CNRS, Paris, France), and E. Schatzman (CNRS, Paris, France) [1970] 73 p refs Prepared in cooperation with CNRS, Paris
(NP-18591) Avail: AEC Depository Libraries

The nuclear physics of the spallation reactions, which lead to the formation of Li, Be, and B by the proton bombardment of light nuclei, is reviewed. A simple rule was devised for classifying the cross sections in terms of their isotopic spin parameters. The physical meaning of this rule is discussed, using calculations based on statistical models. The ratio of the Li, Be, and B isotopes produced by protons of fixed energies or by cosmic-ray protons with an extended energy spectrum were determined. The probable nuclear reactions responsible for the change in the ratios after formation are discussed. The abundance of these elements in nature is discussed and results compared and summarized in terms of creation and decay rates. The meteoritic B-11 to B-10 ratio is shown to be equal to its formation ratio, and the Li-7 to Li-6 formation ratio is shown to be smaller than the meteoritic ratio. A tentative picture of the history of the solar system is given from these results. NSA

N71-28847# Brookhaven National Lab., Upton, N.Y.
SAFEGUARDS APPLICATIONS FOR ISOTOPIC NEUTRON SOURCES
J. R. Beyster (J.R.B. Associates, La Jolla, Calif.) and L. A. Kull (J.R.B. Associates, La Jolla, Calif.) Jun. 1970 121 p refs
(BNL-50267; T-596; JRB-70-108) Avail: NTIS

Neutron sources including (gamma,n), (alpha,n), and fission were examined for their usefulness in performing nondestructive assays of nuclear materials. Physical characteristics, costs, transportation requirements, and availability of each source type are

reviewed and evaluated for use in proposed safeguard assays. The most promising sources are identified and all available sources are tabulated. NSA

N71-26848# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukov (USSR). Inst. Fiziki Vysokikh Energii.
POSSIBILITIES OF CARRYING OUT AN EXPERIMENT ON THE SEARCH FOR W-BOSON IN N N-COLLISIONS AT THE IHEP ACCELERATOR
V. V. Makeev and V. N. Folomeshkin 1969 30 p refs In RUSSIAN; ENGLISH summary
(IFVE-SEF/STF-69-46) Avail: AEC Depository Libraries

The possibilities of carrying out an experiment on the search for W-boson in NN-collision at the IHEP accelerator are presented. The problems of pion-shielding, minimization of the muon background from the pions, and minimization of the muon background from the gamma-quanta etc. are investigated. Author (NSA)

N71-26849# Joint Inst. for Nuclear Research, Dubna (USSR).
MOTION OF THE CHARGED ELECTRON RING IN THE RIPPLE MAGNETIC FIELD
K. A. Reshetnikova 1970 17 p refs In RUSSIAN
(JINR-P9-5394) Avail: AEC Depository Libraries

The effect of the fields, appearing when the charged electron ring passes through the ripple magnetic field, on the motion of electrons inside the ring is considered. Author (NSA)

N71-26851# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
PRECISION APPARATUS WITH LIQUID HYDROGEN TARGET
Yu. T. Borzunov, L. B. Golovanov, V. L. Mazarskii, and A. P. Tsvinev 1970 17 p refs In RUSSIAN
(JINR-P8-5212) Avail: AEC Depository Libraries

Liquid hydrogen targets are used to determine the total cross section of interaction on the basis of the absorption of particles emitted by an accelerator. An installation was built to confine the liquid hydrogen with a precision of 0.05%. It consisted of 2 targets, one of which was filled with liquid hydrogen while the empty one was used for measuring the background. The operating target was refilled by gravity flow by means of a 50 liter storage tank. A mobile support made it possible to place the system in the path of the beam. The 50 liter tank ensured continuous operation of the system for about 50 hours. The valves, measurement and control devices, and auxiliary equipment were located at the panel, using siphons for interconnection. The actual target consisted of an internal cylindrical container, covered with multilayered insulation and a vacuum housing. Steps were taken to prevent interference by bubbles from the boiling hydrogen and to keep the pressure constant. Special windows were provided to reduce the amount of foreign matter in the path of the beam. NSA

N71-26852# Joint Inst. for Nuclear Research, Dubna (USSR).
CALCULATION OF THE PHASE VOLUME OF THE ELECTRON-ION BUNCHES IN THE COLLECTIVE ACCELERATOR AND THE PROBLEMS OF SEPARATION
M. L. Iovnovich, N. B. Rubin, and V. P. Sarantsev 1970 8 p refs In RUSSIAN
(JINR-P9-5405) Avail: AEC Depository Libraries

Motion of protons in the plane of the charged ring, accelerated up to high energies, is investigated. The proton phase volume is calculated. Separation of high energy secondary particles is considered. Author (NSA)

N71-26855# Joint Inst. for Nuclear Research, Dubna (USSR).
AVERAGE FIELD OF THE EXCITED NUCLEI
G. M. Vagradov and B. N. Kalinkin 1970 30 p refs In RUSSIAN; ENGLISH summary
(JINR-P4-5064) Avail: AEC Depository Libraries

The dependence of the potential describing the average nuclear field on the excitation energy is discussed. It is shown that this dependence can be explained by the presence of polarization of the nucleus interacting with a particle or a hole. One can thus connect the results of recent experiments on elastic nucleon scattering with the results on quasi-elastic knocking out of protons in (e,eprime p) and (p, 2p) processes. Possible examples of this effect in nuclear properties at small energies and large deformations are also discussed. Author (NSA)

N71-26856# Joint Inst. for Nuclear Research, Dubna (USSR).
CLASSIFICATION OF STATES AND INTERACTIONS IN THE NUCLEAR COLLECTIVE MODEL
G. N. Afanasjev 1970 20 p refs In RUSSIAN; ENGLISH summary
(JINR-P4-5008) Avail: AEC Depository Libraries

The symmetry properties of the nuclear collective model are studied. It is assumed that the dynamics of this model is correctly described by means of the noncompact group Sp (5,5). The energy spectrum in vibrational or rotational depending on whether the invariance group is isomorphic to SU(5) or to SO(2,1) $\times$ R(5). Author (NSA)

N71-26865# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
STATIC MODEL OF THE S-WAVES IN THE PION NUCLEON SCATTERING AND THE t-CHANNEL PECULIARITIES
V. A. Meshcheryakov and K. V. Rerikh 1970 18 p refs In RUSSIAN
(NIJR-P2-5263) Avail: AEC Depository Libraries

The main t-channel peculiarities corresponding to rho and sigma-mesons are taken into account on the basis of the precise Wander's solution in the static model of the s-wave pionN-scattering. A good description of the experimental data on s-waves up to 260 MeV in t.c.s. is obtained. NSA

N71-26866# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
ON ONE REALIZATION OF REPRESENTATIONS OF THE QUATERNION GROUP
A. N. Leznov and I. A. Fedoseev 1969 7 p refs In RUSSIAN
(IFVE-STF-69-102) Avail: AEC Depository Libraries

The representations of the quaternion group are realized in the space of functions on its maximal compact subgroup. The character of the representations is found, and the equations for the invariant Hermitian form are given. Author (NSA)

N71-26868 Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
DESCRIPTION OF EXPERIMENTAL DATA ON PION NUCLEON AND KAON NUCLEON SCATTERING IN THE HIGH ENERGY REGION ON THE BASIS OF THE COMPLEX ANGULAR MOMENTA THEORY. 1
N. I. Dzhgarkava, Yu. M. Kazarinov, I. K. Potashnikova, and I. N. Silin 1970 18 p refs In RUSSIAN
(JINR-P2-5320) Avail: AEC Depository Libraries

The published experimental data on pion nucleon- and kaon nucleon-scattering in the energy range from 6 to 55 GeV and in the range of transferred momenta up to 1 GeV/c were treated for the purpose of checking the Regge pole hypothesis. The results of experiments on measurements of the total interaction cross sections, of differential cross sections of elastic scattering and the scattering with the charge exchange, of the Wolfenstein parameters R and A and the data of the known resonance belonging to proton, proton, rho meson, omega meson and A sub 2 trajectories were

used. The results show that at more than 40 free parameters only qualitative description of the experimental data can be obtained. Author (NSA)

N71-26870# Kernforschungszentrum, Karlsruhe (West Germany).
ELECTRON ION BUNCH DIAGNOSTICS BY BREMSSTRAHLUNG [ELECTRONEN-IONEN-BUNCH-DIAGNOSTIC MITTELS BREMSSTRAHLUNG]
M. L. Iovnovich et al 1970 8 p refs Transl. into GERMAN from the Russian report in GERMAN
(KFK-TR-337; JINR-P9-4850) Avail: AEC Depository Libraries

The method of accelerating heavy atoms to high energies, based on the possibility of producing electron–ion bunches which are accelerated as a whole through an external magnetic field, produces a bremsstrahlung of the electrons during the capture process. The use of this bremsstrahlung for the diagnosis of the electron–ion bunch was investigated, both theoretically and experimentally. The theoretical study showed that the number of gamma quanta recorded during the capture process depends on the spectral sensitivity of the detector and the detection probability. In the experimental use of a Ge(Li) detector in the acceleration of Xe, the results showed that the capture process of Xe in bunches can be studied with the electron number N(e) > or approximately = 3 × 10 to the 12th power. NSA

N71-26877# Deutsches Elektron-Synchrotron, Hamburg (West Germany).
ON THE CONSEQUENCES OF THE ASSUMPTION THAT THE S-MATRIX COMMUTES WITH THE AXIAL CHARGE
K. Fabricius Nov. 1970 21 p refs
(DESY-70/57) Avail: AEC Depository Libraries

The consequences of the assumption that the axial charge commutes with the S-matrix are derived. Some properties of the axial charge are studied first in perturbation theory and subsequently in a general manner. As a result of the above assumption the self-consistency condition of Adler and in addition the universality of the two-pion isovector coupling are found. Author (NSA)

N71-26878# California Inst. of Tech., Pasadena. Arthur A. Noyes Lab. of Chemical Physics.
PUZZLES IN THE DIFFUSION KINETICS OF THE RADIATION CHEMISTRY OF AQUEOUS SOLUTIONS
Aron Kuppermann [1970] 28 p refs Presented at the Symp. on Very Early Effects at the Intern. Meeting on Primary Radiation Effects in Chem. and Biol., Buenos Aires, 9–14 Mar. 1970 Supported in part by AEC *Its* Contrib. No. 4174
(CALT-767-P-4-73; Conf-700319-1) Avail: NTIS

The time scale under consideration is from the passage of high-energy radiation through the system to approximately one nanosecond thereafter. The simple one-radical diffusion model in radiation chemistry is discussed along with a more generalized model. The effects of scavenger concentration, pH and isotope separation factors are considered. NSA

N71-26879# Oak Ridge National Lab., Tenn.
ELF PROGRAM: DESCRIPTION OF UTILIZATION
Francois Gervaise [1970] 29 p refs Transl. into ENGLISH of French report CEA-Note-N-1361
(ORNL-tr-2409; CEA-Note-N-1361) Avail: NTIS

The ELF program performs Monte Carlo calculations of neutron transport in cylindrical and spherical geometry. Some improvements in the characteristics of ELF and its auxiliary programs are described, and examples of program input data and results are presented. NSA

N71-26935# Stanford Linear Accelerator Center, Calif.
THE SYMMETRIC SPACE OF THE GROUP OF THE MAXWELL EQUATIONS [L'ESPACE SYMETRIQUE DU GROUPE DES EQUATIONS DE MAXWELL]
Armand Wyler Jan. 1971 8 p refs Transl. into ENGLISH from Compt. Rend. Acad. Sci. (Paris), v. 269, 20 Oct. 1969 p 743–745
(SLAC-TRANS-130) Avail: NTIS

A study is made of the group of invariance of the Maxwell equations and of its extension associated with the set of hyperboloids of mass. Calculation of the Poisson kernels on the symmetric spaces leads to a geometric interpretation of the constant e sq times the square root of (hc), for which this theory gives the value 1/137.037. Author (NSA)

N71-26936# Brookhaven National Lab., Upton, N.Y.
SAFEGUARDS GLOSSARY
1 Dec. 1970 22 p refs Sponsored by AEC
(WASH-1162) Avail: SOD $0.25

A list of approximately 110 terms and definitions for use in activities associated with fissionable material safeguards is presented. A later dictionary is planned which will include a longer list of terms and definitions based on usage at each site. NSA

N71-26937# WADCO Corp., Richland, Wash.
IN-CORE REGENERATIVE THERMAL NEUTRON DETECTORS FOR NUCLEAR REACTORS
W. L. Bunch, C. N. Jackson, Jr., W. G. Spear, and M. R. Wood Dec. 1970 65 p refs
(Contract AT(45-1)-2170)
(WHAN-FR-37) Avail: NTIS

Computer studies and preliminary experiments and tests demonstrated the greatly reduced burnup characteristics and subsequent long life performance of a regenerative coating material (90% U-234 and 10% U-235) in developmental thermal neutron detectors. Prototypic sensors exhibited significantly longer life performance, with the sensitivity remaining within 10% of a median value for exposure of 3.5 × 10 to the 21st power nvt at a flux of 3.3 × 10 to the 14th power nv (thermal) in the ETR. This performance surpassed a comparable usable lifetime of the typical U-235 fission chamber by a factor of 15. The regenerative detector achieved this longer operating life without sacrificing other desirable features such as robust signal strength, prompt response and a broad dynamic range. The ETR experiments afforded a direct performance comparison of the regenerative concept device with three other common in-core thermal neutron detectors. Author (NSA)

N71-26939# Sandia Corp., Albuquerque, N.Mex. Electron Beam Physics Research Div.
REBA: A PULSED ELECTRON BEAM GENERATOR
D. L. Johnson Dec. 1970 23 p refs
(SC-DR-70-872) Avail: NTIS

A new electron beam generator, called REBA (Relativistic Electron Beam Accelerator), was designed and constructed. REBA produces 43 kA beams of 3.2 MeV electrons in 70 nsec pulses at a rate of up to 40 shots per day. A unique feature of REBA is that a single Marx generator can pulse charge either of two Blumlein transmission lines and thus provides two independent sources of electrons for experimenters. The research and design considerations and the preliminary operating parameters of REBA are discussed. Preliminary electron beam measurements are also presented. Author (NSA)

N71-26940*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
STUDY OF VIBRATIONAL EXCITATION MECHANISMS OF CO2 AT HIGH TEMPERATURES
Joseph W. Rich, Ronald G. Rehm, and Charles E. Treanor Washington NASA May 1971 66 p refs
(Contract NAS2-4185)
(NASA-CR-1841) Avail: NTIS CSCL 20H

Results of calculations for the vibrational excitation of CO2 are reported, for both a model which includes anharmonic coupling among the vibrational modes, and for an approximate normal mode

model. Energy transfer from the CO2 states in collision with rare gas atoms was studied using the coupled-mode model. Very close coupling between the symmetric stretching and bending modes is predicted during such collisions. Special features of a multistate calculation of CO2 vibrational excitation were compared with a first order perturbation calculation. It is found that for some CO2 transitions, several coupled states must be retained for an accurate calculation. The effects of potential anisotropy and participation of the rotational energy mode were also investigated, using the normal mode model. The rotational mode is shown to make a contribution to vibrational excitation over a considerable range of relative translational energies in the collision. The overall magnitude of the probabilities for vibrational excitation and the degree of participation of the rotational mode show marked dependence on the potential anisotropy. Comparisons of coplanar and three dimensional calculations of the CO2 bending mode collisional excitation show no significant difference in the two calculations over a large temperature range. Author

N71-28945# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).

USE OF HAUSER-FESHBACH THEORY FOR PREDICTING INELASTIC SCATTERING OF NEUTRONS BY NUCLEI

W. K. Bertram Jul. 1970 24 p refs

(AAEC/TM-545) Avail: AEC Depository Libraries

Cross sections for inelastic scattering of neutrons by nuclei are investigated using the Hauser–Feshbach theory. With transmission coefficients calculated from the optical model using a potential equivalent to the nonlocal potential of Perey and Buck, it is shown that it is possible to predict inelastic scattering cross sections with satisfactory results, provided corrections due to level width fluctuations are taken into account. Author (NSA)

N71-28948# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).

THE CALCULATION OF (n,2n) CROSS SECTIONS USING THE HAUSER-FESHBACH THEORY

W. K. Bertram May 1970 14 p refs

(AAEC/TM-542) Avail: AEC Depository Libraries

The statistical theory of Hauser and Feshbach was used to calculate the (n,2n) cross sections of Cu-63, Au-197, Tl-203, Th-232, and U-238, for incident neutron energies below the (n3n) threshold. Results were compared with experiment and with the results from the evaporation model. Author (NSA)

N71-28959# Kyoto Univ. (Japan). Research Reactor Inst.

PROBLEMS RECENTLY ENCOUNTERED IN RADIATION CHEMISTRY

Hiroshi Yoshida, ed. 1969 23 p refs In JAPANESE Presented at Various Probl. Recently encountered in Radiation Chem., Kyoto, 23 Dec. 1968

(KURRI-TR-62; CONF-681230) Avail: AEC Depository Libraries

Abstracts of four papers delivered at the research conference on Various Problems Recently Encountered in Radiation Chemistry held on December 23, 1968 at the Research Reactor Institute of Kyoto University are presented. The first paper discusses electrons in condensed phases which treats the subjects of the G-value of electron (hydrated) formation, size of the tracks, diffusion theory, and ion reactions. The second paper considers the application of cyclotron resonance to chemical reactions and associated problems. The advantages and problems associated with Mossbauer spectroscopy are discussed in the third paper. The subject of the final paper is radiation chemistry at very low temperatures. It reviews earlier work done and discusses the problems associated with the radioinduced polymerization of acrylamide. The problem of trapped electrons in organic glasses is also considered. NSA

N71-28981# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).

BOPTIC: A BEAM TRANSPORT PROGRAM IN FORTRAN 4

G. R. Dangerfield and R. L. Walsh Jul. 1970 44 p refs

(AAEC/TM-544) Avail: AEC Depository Libraries

The FORTRAN 4 program BOPTIC is designed to analyze the behavior of a beam of monoenergetic charged particles in a postacceleration beam transport system. This system may comprise any number of bending magnets, quadrupole magnets or flight tubes, arranged in any desired order. Matrix methods are employed to calculate the displacement and divergence of the beam as it traverses the system. Various optimization features are included. Author (NSA)

N71-28982# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.

FROZEN POLARIZED TARGET

P. H. T. Banks, D. A. Cragg, D. R. Madden, D. J. Nicholas, D. C. Pickles et al 27 Aug. 1970 18 p refs Presented at the 3d Intern. Symp. on Polarization Phenomena in Nucl. Reactions, Madison, Wis., Sep. 1970

(RPP/A-81; CONF-700811-2) Avail: AEC Depository Libraries

A polarized proton target currently under development at the Rutherford Laboratory is described. The target has the twin objectives of high polarization and large angular access. In this new polarized target the material is first polarized by the solid-effect and when a high degree of polarization has been established the temperature of the target is lowered until the process of depolarization through spin relaxation becomes very slow. In this state the polarization is frozen-in and the target transferred to a holding magnetic field of low homogeneity but giving large angular access. Details are given of the design of the target together with the results obtained from work carried out to find a suitable material for this type of target. Porphyrexide-doped aqueous solutions of glycerol and porphyrexide-doped aqueous solutions of 1-butanol were studied. Author (NSA)

N71-28992# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).

APPLICATION OF VARIATIONAL METHODS TO NEUTRON TRANSPORT IN SLABS

I. J. Donnelly Aug. 1970 21 p refs

(AAEC/TM-554) Avail: AEC Depository Libraries

Monoenergetic neutron transport in a homogeneous slab is investigated, using two different formulations of the variational method and a simple trial function. One form leads to results that are correct for thick slabs, while the other is in error. An improved trial function is then developed to overcome a difficulty encountered in the simple one when the variational method is applied to slab materials that conserve neutrons. Author (NSA)

N71-27022*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MOLECULAR DYNAMICS OF POLAR GAS ROTATIONAL RELAXATION

Frank J. Zeleznik, John V. Dugan, Jr., and Raymond W. Palmer Washington Jun. 1971 47 p refs

(NASA-TN-D-6356; E-5852) Avail: NTIS CSCL 20H

A 50 molecule sample in contact with a heat bath of similar molecules is used as a model to calculate the rotational collision numbers Z sub rot for HCl and DCl at 300 and 500 K, by the method of molecular dynamics. The mean rotational energy of the sample exhibits an exponential approach to a steady state value; however, there is considerable scatter about the exponential curve. The results for Z sub rot generally agree with previous theoretical calculations and these results are intermediate to both experimental acoustic data and the earlier perturbation results. Author

N71-27047# Tubingen Univ. (West Germany). Physikalisches Inst.

TUEBINGEN UNIVERSITY INSTITUTE OF PHYSICS ANNUAL REPORT, 1967–1968 [PHYSIKALISCHES INSTITUT DER UNIVERSITAET TUEBINGEN JAHRESBERICHT 1967–1968]

Aug. 1970 103 p refs In GERMAN; ENGLISH summary
(BMBW-FBK-70-14) Avail: AEC Depository Libraries

The following experiments are reported: neutron polarization in the elastic and inelastic scattering of neutrons on C-12, and in the reaction H-3(d,n)He-4; angular distributions, and analysis of power in (n, alpha)-reactions on Nd-142, Ce-140, La-139, Ba-138, Zn-64, Xe-54, and C-12; mass, energy and angular distribution of fission fragments in U-238(n,f) and Th-232(n,f); interactions of nuclear multipole moments with atomic electrons by HFS-investigations on Na-23, Yb-171, and Yb-173; and investigation of the elementary process of bremsstrahlung production by electrons in the Coulomb field of the nucleus. Author (NSA)

N71-27069# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.

DEBYE-WALLER FACTOR FOR TUNGSTEN

Yu. A. Alexandrov, A. M. Balagurov, G. S. Samosvat, and L. E. Fykin 1970 9 p refs In RUSSIAN
(JINR-P14-5358) Avail: AEC Depository Libraries

The Debye–Waller factor for tungsten is calculated according to the data on heat capacity. The diffraction Debye temperature for T = 293 K turned out to be 343 K. The obtained result is compared with the calculation of the Debye–Waller factor on the phonon spectrum of tungsten and with the neutron-diffraction experiment. Author (NSA)

N71-27070# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

ON THE K13 DECAYS IN CHIRAL DYNAMICS

M. A. Eliashvili 1970 19 p refs In RUSSIAN
(JINR-P2-5290) Avail: AEC Depository Libraries

Effective Lagrangian calculation of K(13) form factors is performed using the additional assumption about the smoothness of kaon resonance - kaon pion vertex. The relation between Glashow–Weinberg bounds on the kappa-meson mass and SU(3) × SU(3) symmetry breaking parameter is established. The new values of decay constants F sub kaon and F sub kappa are obtained. Author (NSA)

N71-27071# Oak Ridge National Lab., Tenn.

A NEW TRANSURANIUM ELEMENT FOUND IN NATURE

Andrei Nikitin [1970] 12 p Transl. into ENGLISH from Nauka i Zhizn (Moscow), no. 5, 1970 p 102–107
(ORNL-tr-2428) Avail: NTIS

An outline of the discovery of element 108, named sergenium, in samples of volcanic rock is presented. The element is proposed to have chemical properties similar to osmium and a half-life of 4 to 5 million years. NSA

N71-27072# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

ON THE EQUALITY OF LOCAL ALGEBRAS OF RELATIVISTIC QUANTUM FIELD THEORY

M. A. Smondyrev 1970 13 p refs In RUSSIAN
(JINR-P2-5330) Avail: AEC Depository Libraries

In the framework of the algebraic approach of Haag–Araki type to the axiomatic quantum field theory a necessary and sufficient condition for the equality of two local W*-algebras R(O sub 1) and R(O sub 2) is proved. Author (NSA)

N71-27073# Rome Univ. (Italy). Ist. di Fisica.

AN UPPER LIMIT ON THE OMEGA MESON YIELDS 2 PION DECAY RATE FROM ANTIPROTON-NEUTRON ANNIHILATION AT REST

R. Bizzarri, G. Ciapetti, U. Dore, M. Gaspero (Camerino Univ.), P. Guidoni et al 1970 12 p refs
Avail: NTIS

Antiproton-neutron annihilations at rest (L=0) into G-parity states of opposite sign are incoherent. This permits a measurement of the ratio R = (omega approaches limit of pi(+)pi(−))/(omega approaches limit of pi(+)pi(−)pi(0)) in the absence of omega-rho interference. In this way the upper limit R less than 4.3% at the 95% confidence level is found. Author (ESRO)

N71-27074# Joint Inst. for Nuclear Research, Dubna (USSR). Neutron Physics. Lab.

COHERENT SCATTERING AMPLITUDE OF TUNGSTEN-186 MEASURED BY SMALL ANGLE SCATTERING

Yu. A. Alexandrov, L. Koester, and G. S. Samosvat 1970 11 p refs
(JINR-E3-5371) Avail: AEC Depository Libraries

The Christiansen filter technique was used. The scattering amplitude of tungsten was determined from the condition of identity of the refractive indices of a powder and a liquid when the small angle scattering of neutrons passing through the filter is negligible. For the mixture of tungsten isotopes containing 90.7% of W-186, the coherent scattering amplitude of neutron with the average wavelength of about 15 A was found to be (−0.466 + or − 0.006) F. Author (NSA)

N71-27077# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

STORING TRACKS IN STREAMER CHAMBERS

V. Eckardt Nov. 1970 13 p refs
(DESY-70/60) Avail: AEC Depository Libraries

It is shown that a streamer chamber has storage capabilities for particle tracks when two high voltage pulses are applied to the chamber in succession. The first storage pulse produces invisible avalanches containing metastable states with a decay time of about 0.001 seconds. The second record pulse is the usual high voltage pulse for streamer photography. At a memory time for free electrons of less than 0.000001 seconds a storage time of a few 0.001 seconds is shown to be possible without loss in the accuracy of track location. Author (NSA)

N71-27078# Bettis Atomic Power Lab., Pittsburgh, Pa.

EVALUATION OF THE RADIATIVE NEUTRON CAPTURE CROSS SECTIONS OF Th 232 FOR THE RANGE 0.0 eV TO 15 MeV (LWBR DEVELOPMENT PROGRAM)

N. M. Steen Dec. 1970 94 p refs
(Contract AT(11-1)-Gen-14)
(WAPD-TM-971) Avail: NTIS

An evaluation of the radiative neutron capture cross sections of Th-232 in the range 0.0 eV to 15 MeV was performed. The result is a fully parameterized representation. Of primary interest is the p-wave strength function, which is found to be (0.914 + or − 0.1) × 0.0001 for a 3-degree-of-freedom model. The 2200 m/s cross section is found to be 7.345 + or − 0.05 barns with a g-factor of 0.9956. The infinite dilute integral is 85.24 barns. These data were used to reanalyze the ThO2 integral measurements of Hardy and Palowitch starting from the experimental activation rates. The resulting experimental and calculated integrals show excellent agreement, as do the calculated and experimental values of I/I sub 0 for Th-232 metal rods. The reanalysis of the ThO2 integral experiments resulted in a reduction of the experimental integrals of up to 3.5 percent. Author

N71-27079# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).

FISSION PRODUCT CROSS SECTIONS

J. L. Cook Jun. 1970 14 p refs
(AAEC/TM-549) Avail: AEC Depository Libraries

Work on the evaluation of the major 188 fission-product

cross sections for use in reactor burnup calculations is outlined. The thermal region was dealt with using measured data where available, and knowledge of the statistics of resonances where no measurements have been made. The statistical region was computed using the full statistical theory with partial waves up to D states, while the fast region was calculated using the Perey–Buck version of the optical model. A standard library is being prepared containing these data. Author (NSA)

N71-27080# Lyon Univ. (France). Inst. de Physique Nucleaire.
STUDY OF SOME NUCLEI OF THE 1p AND 2s-1d SHELLS USING THE HARTREE–FOCK METHOD [ETUDE DE CERTAINS NOYAUX DES COUCHES 1p ET 2s-1d PAR LA METHODE DE HARTREE–FOCK]
Anne-Marie Delalex (Ph.D. Thesis) 24 Jun. 1970 82 p refs In FRENCH
(LYCEN-7047) Avail: AEC Depository Libraries

With the view of making comparisons with experimental results, the Hartree–Fock method for calculating the configurational energies of light nuclei is described. In particular, 4n nuclei with 1 p and 2s-1d shells were studied. The phenomenological potentials of Volkov, Manning, Brink, Boeker and Monsonego were used to study the spherical nuclei of He, O-16 and Ca-40 and the deformed nuclei Be-8 and C-12. The results obtained were in good agreement with those obtained by other workers. The conditions appropriate to the application of this method are described. The representation consisted of harmonic oscillator states considered on a cylindrical base and corresponding in three complete shells. NSA

N71-27081# Tokyo Univ. (Japan). Inst. for Nuclear Study.
CONTROL AND READ OUT SYSTEM OF SCALER
26 Jun. 1970 48 p refs In JAPANESE and ENGLISH
(INS-TH-67) Avail: AEC Depository Libraries

Measurements on the differential cross sections at 180 deg for the reactions gamma proton yields positive pion neutron and gamma neutron yields negative pion proton were made recently. In this experiment 27 scalers were used in connection with three coincidence counters, one veto-coincidence counter, and a hodoscope consisting of 10 elements. Since data were taken repeatedly in a short interval, an accurate and expedient read-out of scalers was required. An apparatus having the following functions was made: (1) it controls 27 scalers; (2) it reads out the data of the scalers to a printer and a perforator; (3) it controls a simple precision flux meter. A detailed description of the apparatus is given. Author (NSA)

N71-27082# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
EXAMPLE OF THE INFINITE-COMPONENT LOCAL FIELD WITH THE MASS SPECTRUM
R. P. Zaikov and Ch. D. Palev 1970 7 p refs In RUSSIAN
(JINR-P2-5305) Avail: AEC Depository Libraries

An example of the local infinite-component field with a mass spectrum, which is transformed over the nonunitary irreducible representation of Sp(4) group, is considered. Author (NSA)

N71-27083# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
QUASI-POTENTIAL EQUATION FOR THE RELATIVISTIC HARMONIC OSCILLATOR
A. D. Donkov, V. G. Kadyshevsky, M. D. Mateev, and R. M. Mir-Kasimov 1970 29 p refs
(JINR-E2-5339) Avail: AEC Depository Libraries

In the framework of the quasi-potential approach the relativistic generalization of the exactly soluble problem of the harmonic oscillator is studied. The quasi-potential wave functions are constructed as the expansions in terms of the wave functions of the corresponding nonrelativistic problem. The relativistic corrections to the energy levels are obtained. Author (NSA)

N71-27103# Joint Inst. for Nuclear Research, Dubna (USSR). Lab of Theoretical Physics.
POISSON DISTRIBUTION OF SECONDARY PARTICLES IN STRAIGHT-LINE PATHS APPROXIMATION
B. M. Barbashov, S. P. Kuleshov, V. A. Matveev, V. N. Pervushin, and A. N. Sisakyan 1970 19 p refs
(JINR-E2-5329) Avail: AEC Depository Libraries

The problem of multiple production of soft mesons in high-energy two-nucleon collisions is considered in the framework of standard quantum field theory models. The straight-line paths approximation is used to obtain the Poisson distribution of the secondary particle number and to investigate the average particles as a function of the choice of the integral cutoff parameters in various asymptotic regions. Author (NSA)

N71-27113# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
QUASI-ELASTIC SCATTERING OF PARTICLES ON DEUTERONS
A. V. Tarasov and Ch. Tseren 1970 13 p refs In RUSSIAN
(JINR-P2-5343) Avail: AEC Depository Libraries

In the energy region, where the Glauber approximation cannot be applied, a number of simple expressions was obtained for the cross section of a particle scattered by a deuteron at a certain angle. These expressions include the effects of the double interaction of the particle with the deuteron nucleons. Author (NSA)

N71-27114# Centre National de la Recherche Scientifique, Marseilles (France). Centre de Physique Theorique.
APPLICATIONS OF THE THEORY OF DIRICHLET SERIES TO THE SUPERPOSITION OF AN INFINITE NUMBER OF REGGE POLES
J. Mandelbrojt and S. Mandelbrojt (Coll. de France) 1970 17 p refs
(CNRS-CPT-70-P-330) Avail: AEC Depository Libraries

The theory of Dirichlet series is the most fruitful general framework for studying the superposition of an infinite number of Regge poles. A theorem was given which shows that daughter trajectories spaced by one unit are introduced in the theory of Dirichlet series, in a natural way. The intercept of the daughter trajectories in the Chew Frautschi plot for every value of t was studied. The daughter trajectories asymptotically in n were shown to be parallel and spaced by one unit. NSA

N71-27120# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Reaktorphysik.
MEASUREMENT OF NEUTRON SPECTRA IN THE ENERGY RANGE FROM 1 eV TO 10 keV WITH THE HELP OF SANDWICH TECHNIQUES [MESSUNG VON NEUTRONENSPEKTREN IM ENERGIEBEREICH VON 1 eV BIS 10 keV MIT HILFE DER SANDWICHTECHNIK]
Manfred Mueller (Ph.D. Thesis – Tech. Hochschule, Karlsruhe, West Ger.) Jul. 1970 103 p refs In GERMAN; ENGLISH summary
(KFK-1233) Avail: AEC Depository Libraries

Twenty one different resonance absorbers were investigated theoretically and experimentally in order to check their suitability as sandwich detectors for the determination of neutron spectra in fast ractors below the energy of 10 keV. The obtainable accuracy of the measured results of all detectors was found to be influenced strongly by the hardness of the neutron spectrum. By means of the absolute cross sections of gold (Au) and manganese (Mn) the results could be given absolutely. The accuracy of the measurements was 10 to 20% for spectra similar to those in a fast steam cooled breeder reactor and 20 to 40% for spectra similar to those in a fast sodium cooled breeder reactor. Author (NSA)

N71-27121# National Inst. for Research in Nuclear Science, Chilton (England). Rutherford High Energy Lab.

NEW TARGET MATERIAL FOR THE RUTHERFORD FROZEN TARGET

F. M. Russell Sep. 1970 11 p refs
(RHEL/R-199) Avail: AEC Depository Libraries; HMSO 2s 6d; BIS $0.60

Measurements were made of the nuclear spin relaxation times for various organic target materials in the temperature region below 2K and at magnetic field strengths greater than 25 kG. A mixture of glycerol: water with porphyrexide gives long relaxation times and high polarizations and was selected for use in the Rutherford frozen polarized target. Author (NSA)

N71-27122# Kernforschungszentrum, Karlsruhe (West Germany). Zyklotron-Lab.

INVESTIGATION OF THE BETA SPECTRUM OF C-14 WITH A PROPORTIONAL COUNTER WITH INNER ANTICOINCIDENCE SCREENS [UNTERSUCHUNG DES BETA SPEKTRUMS VON C-14 MIT EINEM PROPORTIONALZAEHLROHR MIT INNERER ANTIKOINZIDENZABSCHIRMUNG]

W. R. Gramm, S. K. Thio, H. Rebel, and R. Loehken Sep. 1970 33 p refs In GERMAN; ENGLISH summary
(KFK-1222) Avail: AEC Depository Libraries

The beta spectrum of C-14 was measured using a multiwire proportional counter and gaseous C-14 sources. The spectrum measurements at different pressures result in clear deviations from the statistical shape. The shape factor has been analyzed in terms of higher order nuclear matrix elements contributing to allowed Gamow – Teller transitions. Author (NSA)

N71-27123# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

MEASUREMENT OF THE SCATTERING ANGLE OF PARTICLES BY VAVILOV-CHERENOKOV RADIATION AT HIGH ENERGIES

V. I. Ivanov, N. S. Moroz, V. B. Radomanov, V. S. Stavinskii, and V. N. Zubarev 1970 10 p
(JINR-E13-5459) Avail: AEC Depository Libraries

Angular resolution characteristics and efficiencies of the 6-channel Cherenkov hodoscope in the interval of angles from 0 to 30 mrad were obtained. Author (NSA)

N71-27141# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.

SOLUTION OF THE UNITARITY EQUATION FOR THE ELASTIC SCATTERING AMPLITUDE AT HIGH ENERGY

O. A. Khrustalev, V. I. Savrin, and N. E. Tyurin 1969 21 p refs In RUSSIAN
(IFVE-STF-69-65) Avail: AEC Depository Libraries

The unitarity equation is solved for the elastic scattering amplitude at high energy and at $-t << S$, when the contribution of the inelastic processes and the phase of a purely elastic scattering are given. Author (NSA)

N71-27144# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Kernphysik.

STUDIES OF RADIATIVE NEUTRON CAPTURE AND DELAYED FISSION GAMMA-RAY SPECTRA FROM URANIUM AND PLUTONIUM AS A BASIS FOR NEW NONDESTRUCTIVE SAFEGUARDS TECHNIQUES

P. Matussek, W. Michaelis, C.Weitkamp, and H. Woda Jul. 1970 19 p refs Presented at the IAEA Symp. on Progr. in Safeguards Tech., Karlsruhe, West Germany, 6 – 10 Jul. 1970
(KFK-1214; CONF-700701-5; SM-133/33) Avail: AEC Depository Libraries

The thermal-neutron induced gamma-ray spectra from U-235 and Pu-239 samples were studied with a Ge(Li) detector. The integral spectrum is a superposition of gamma rays from the neutron capture reaction, prompt gamma rays from fission, and delayed gamma rays emitted from fission products. The prompt fission and capture gamma-ray spectra were obtained by means of a 4pion plastic scintillator for the detection of prompt fission neutrons, the detector being operated in coincidence and anti-coincidence with the Ge(Li) detector, respectively. A combination of three mechanical choppers covering a decay time range from microsec to 1 sec served for the measurement of the different components of the delayed spectra. On the basis of the data measured new approaches for detection, identification, and quantitative analysis of nuclear fuel are proposed that are nondestructive, prompt, accurate, and isotope specific. The results of the measurements are discussed in view of this application. Author (NSA)

N71-27145# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

EMPIRICAL TEST OF TENSOR MESON DOMINANCE

B. Renner Nov. 1970 7 p refs
(DESY-70/58) Avail: AEC Depository Libraries

The assumption of meson pole dominance for matrix elements of the energy momentum tensor is tested using empirical results on tensor meson decay widths and nucleon coupling constants. Its most significant consequence is the decoupling of the f-exchange contribution from the A amplitude in pion-nucleon scattering. Author (NSA)

N71-27148# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).

CROSS SECTIONS FOR NUCLEAR REACTIONS PRODUCED BY DEUTERONS ON TANTALUM [SECCIONES EFICACES PARA LES REACCIONES NUCLEARES PRODUCIDAS POR DEUTERONES SOBRE TANTALO]

I. de Bentancourt and S. J. Nassiff (Inst. de Asuotos Nucleares) 1970 11 p refs In SPANISH
(CNEA-269) Avail: AEC Depository Libraries

The cross sections for the nuclear reactions Ta-181(d,p)Ta-182 and Ta-181(d,2n)W -181 were determined experimentally. The deuteron energy in the incident beam was 27.2 MeV. The stacked foil technique was used to reduce its energy to the value corresponding to the threshold. The results obtained are tabulated and agree well with the experimental values obtained by Lange and Numzel. Author (NSA)

N71-27154# Kyoto Univ. (Japan). Research Reactor Inst.

SECOND NEUTRON MEASUREMENTS SYMPOSIUM

Keiju Kanda, Keiji Kobayashi, and Itsuo Kimura, eds. 1969 85 p refs In JAPANESE Conf. held at Kyoto, 20 Feb. 1969
(KURRI-TR-59; CONF-690224) Avail: AEC Depository Libraries

Abstracts of thirteen papers are presented. The subjects covered include: Standard thermal neutron field in the KUR heavy water facility; the spectrum of the KUR graphite thermal column; calibration of neutron measurements in the epithermal region; standard thermal and epithermal neutron fields by means of a neutron generator; measurement of intermediate neutron spectrum with LINAC; standard resonance region spectrum pile TAKIT-2; transmission experiment with fast, continuous spectrum neutrons; fast neutron experiments with LINAC; wave form discrimination of He-3 proportional counter; measurement of fast neutron spectrum with He-3 proportional counter; analysis of pulse height distribution; studies on the semiconductor proton recoil counter; proton recoil counter with gamma-discrimination; and error evaluation on multi-detector methods in neutron dose measurements. (NSA)

N71-27171# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.

MEASUREMENT OF THE ORIENTATION OF THE RESIDUAL NUCLEUS AND SEVERAL DIFFERENTIAL INTERACTION CROSS SECTIONS IN THE REACTION Fe-56(d,p) Fe-57 [MESSUNG DER ORIENTIERUNG DES RESTKERNS UND EINIGER DIFFERENTIELLER

WIRKUNGSQUERSCHNITTE AN DER REAKTION Fe-56(d,p) Fe-57]

G. Bueche (Ph.D. Thesis – Technische Hochschule, Karlsruhe) Jun. 1970 87 p refs In GERMAN

(NP-18439) Avail: AEC Depository Libraries

The spin dependence of the nuclear energy orients the angular momentum of the particles in the final states of a reaction. After (d,p) stripping reactions, the rest nucleus polarization was investigated in comparison with the rare nucleon polarization. The Moessbauer effect opened for some nuclei the possibility that, from the hyperfine structure splitting of its states, information could be obtained on the orientation of the nucleus after reaction. For residual nuclei of the reaction Fe-56(d,p) Fe-57(14 keV), from the intensity distribution of the hyperfine structure transition (3/2, + or − 3/2) yields (1/2, + or − 1/2) in coincidence with protons, the orientation in the (3/2, + or − 3/2) states are measured. The possible disturbances to the orientation of the residual nucleus are discussed. The differential cross section at deuteron energy of 5.5 MeV was measured for excitation energies below 3 MeV. Author (NSA)

N71-27172# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

A SIMPLE INTERPRETATION OF INELASTIC ELECTRON-NUCLEON SCATTERING

Victor F. Weisskopf Oct. 1970 8 p refs Prepared in cooperation with MIT, Cambridge, Mass.

(DESY-70/50) Avail: AEC Depository Libraries

The main features of the deep inelastic scattering of electrons by neutrons and protons can be explained by a simple model of the nucleon consisting of partons. It turns out that the best results are obtained if the nucleon is assumed to be a linear combination of states with three quarks and a varying number of quark-antiquark pairs with the usual fractional charges. Author (NSA)

N71-27173# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

MEASUREMENT OF PROTON COMPTON SCATTERING IN A 6 GeV AND SMALL MOMENTUM TRANSFERS

G. Buschhorn, L. Criegee, L. Dubal, G. Franke, G. Geweniger et al Sep. 1970 12 p refs

(DESY-70/46) Avail: AEC Depository Libraries

Compton scattering on protons was measured at a mean photon energy of 6 GeV and four momentum transfers −t between 0.06 and 0.60 (GeV/c)(2). The differential cross section shows a diffraction like behavior. The cross section extrapolated to t = 0 is in fair agreement with the optical point. Discrepancies with the vector meson dominance model are pointed out. Author (NSA)

N71-27174# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

ON THE INVARIANCE OF THE NONRELATIVISTIC HAMILTONIAN-JACOBI EQUATION IN THE PRESENCE OF THE ELECTROMAGNETIC FIELD

V. N. Strel'tsov 1970 5 p refs In RUSSIAN

(JINR-P2-5373) Avail: AEC Depository Libraries

It is shown that the nonrelativistic Hamiltonian−Jacobi equation for a particle in the electromagnetic field is invariant relative to nonrelativistic phase transformations. Author (NSA)

N71-27175# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

NEW VACUUM TRAJECTORY FOR PION-NUCLEON SCATTERING

Kurt Sundermeyer Oct. 1970 24 p refs

(DESY-70/55) Avail: AEC Depository Libraries

It is shown that the asymptotic behavior of the isospin-zero part A(+) of the invariant amplitude alpha in pion nucleon-scattering is determined by a vacuum trajectory with alpha (0) = −0.47 + or − 0.17. With duality arguments and continuous-moment sum rules the assumption is confirmed that s-channel helicity is conserved in pion nucleon-scattering. Because of the smallness of the trajectory, the influence of strong contributions of Delta(1236) and possible complications by wrong signature nonsense points, the slope cannot be satisfactorily determined. Author (NSA)

N71-27181# Argonne National Lab., Ill. Applied Mathematics Div.

PENETRATION AND CASCADE PHENOMENA

G. Zgrablich Aug. 1970 75 p refs

(Contract W-31-109-eng-38)

(ANL-7727) Avail: NTIS

Two penetration phenomena problems at low energies and two at very high energies are treated. The stopping probability in a material of a given thickness is studied. The corresponding integro-differential equation is shown to have a regular solution accounting for a finite number of collisions, and a singular solution representing the contribution from an infinite number of collisions. The general solution is unique if and only if the singular solution is identically zero. The ionization cascade is investigated produced by a charged particle. The distribution of ion pairs produced is computed. The mean number of ion pairs conditional on a given energy loss by the primary is shown to be linear and independent of primary energy, varying little with the nature of the absorber. The computer energy loss per ion-pair produced is in good agreement with experiments. Multiple particle production models at cosmic ray energies and their predictions for quantities such as inelasticity and multiplicity distributions are examined. Special attention is paid to the two-temperature model. Dissert. Abstr.

N71-27182# Joint Inst. for Nuclear Research, Dubna (USSR).

TIME-OF-FLIGHT AND COORDINATE MEASUREMENTS IN A 130 cm SCINTILLATION COUNTER

R. G. Astvatsaturov, M. N. Khachaturyan, I. F. Kolpakov, and V. A. Smirnov 1970 12 p refs

(JINR-E1-5098) Avail: AEC Depository Libraries

By measuring the time interval between the arrival of the light signals at two opposite ends of a scintillator, the accurate determination of a coordinate is achieved in a long scintillation counter. As one of the basic counters, this counter was simultaneously used for time of flight measurements. The counter is 8 × 8 × 130 sq cm. The accuracies of the coordinate and time of flight determination obtained in the experiment for charged particles are equal to + or − 1.7 cm and + or − 0.38 sec, respectively. It is shown that the accuracies of time of flight measurements and of the coordinate determination depend on the counter geometry. Author (NSA)

N71-27183# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

COMPILATION OF PHOTOPRODUCTION DATA ABOVE 1.2 GeV

Peter Joos, comp. 23 Sep. 1970 142 p refs

(DESY-HERA-70-1) Avail: AEC Depository Libraries

A compilation is presented of 3477 existing data from 243 references on experimental photoproduction above 1.2 GeV. Author (NSA)

N71-27184# Delaware Univ., Newark. Dept. of Physics.

RADIATION INDUCED DEFECTS IN ALKALI HALIDES, AND THEIR ROLE IN RECOMBINATION PROCESSES Final Report, 1 Mar. 1967–15 Jul. 1970

R. B. Murray 22 Jan. 1971 13 p refs

(Contract AT(30-1)-3842)

(NYO-3842-12) Avail: NTIS

A summary is presented of research on the following areas: luminescence from (electron + V(k)) recombination processes, mechanism of producing vacancy defects, optically stimulated

orientation of V(K) centers, diffusion of the V(K) polaron, and effects of channeling on the scintillation response of NaI(Tl) to heavy ions. NSA

N71-27197# Joint Inst. for Nuclear Research, Dubna (USSR).
COVARIANT DENSITY MATRIX FOR ARBITRARY SPIN PARTICLES
B. Z. Kopeliovich 1970 23 p refs In RUSSIAN; ENGLISH summary
(JINR-P2-4931) Avail: AEC Depository Libraries

The covariant expression of the polarization density matrix, or the projection operator, for the arbitrary integer or half-integer spin is derived in an explicit form. The covariant formalisms of Pauli–Firz and Rarita–Schwinger are used for describing higher fields. NSA

N71-27199# Joint Inst. for Nuclear Research, Dubna (USSR)
SLOW COLLISIONS IN THE SYSTEM OF THREE BODIES INTERACTING ACCORDING TO THE COULOMB LAW. 4: MESIC ATOM PROCESSES IN HYDROGEN
A. V. Matveenko and L. I. Ponomarev 1970 36 p refs In RUSSIAN
(JINR-P4-5039) Avail: AEC Depository Libraries

A general approach, developed for solution of the problem of three bodies interacting according to the Coulomb law, was used for calculations of specific reactions involving negative muon mesons and the hydrogen isotopes. The cross sections and the constants of interception are obtained for negative muon-meson transitions between hyperfine-structure levels and for the isotope exchange reactions p negative muon + d / p + d negative muon, p negative muon + t – p + t negative muon, and d negative muon + t – d + t negative muon. The calculated results are compared with previous calculations and experimental data. Author (NSA)

N71-27226# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
GEOMETRIC CORRECTION FACTORS RELATING TO THE RECOIL OF PROTONS IN NUCLEAR EMULSIONS [FACTEURS DE CORRECTION GEOMETRIQUE RELATIFS AUX PROTONS DE RECUL DANS LES EMULSIONS NUCLEARIES]
Henry Viaiettes and Phung Le Thanh Oct. 1970 29 p refs In FRENCH
(CEA-R-4801) Avail: AEC Depository Libraries

The geometric correction factors relative to measurements carried out on the spectra of recoil protons, obtained using nuclear emulsions, are discussed. These factors take into account the probability of a proton track being wholly contained within the emulsion. Two aspects relative to radioprotection are considered: the case of quasi-point source for which a single rectangular shaped emulsion surface is used (the length of this surface is along the same axis as that of the incident neutrons; and the case of an incident flux of neutrons of indeterminate direction. The first case is only briefly reviewed. The second case is extensively treated. The numerical values obtained for the correction factor relative to the length of proton tracks in emulsions of 200, 400 and 600 micrometers are indicated. The validity of these corrections is demonstrated in the determination of the neutron emission spectra of an americium fluorine source, and by the D(d,n) He-3 reaction. Author (NSA)

N71-27227# Brown Univ., Providence, R.I. Dept. of Physics.
OKUBO'S SECOND CLASS CURRENTS IN K SUB l2 AND K SUB l3 DECAYS
Kyungsik Kang and Robert Olshansky [1970] 11 p refs Supported in part by AEC
(NYO-2262-TA-236) Avail: NTIS

The modification of the weak interaction theory recently proposed by Okubo is compared with the current-current weak interaction theory generalized to include local scalar or tensor interactions for K sub l2 and K sub l3 decays. In contrast to the latter type of theory, the existence of Okubo's tensor or scalar densities in difficult to verify from K sub l2 and K sub l3 experiments unless one has a reliable theoretical model for the pure V-A vertices. In particular, various possible explanations for the K sub l3 parameters are discussed. Author (NSA)

N71-27228# European-American Nuclear Data Committee, Paris (France).
NUCLEAR DATA RESEARCH IN THE EURATOM COMMUNITY Progress Report, 1 Jan.–31 Dec. 1969
Mar. 1970 260 p refs
(EANDC(E)-127(U)) Avail: AEC Depository Libraries

Progress on nuclear data research in the Euratom community during 1969 is reported. The work was done at 24 institutions in the Netherlands, Germany, Italy, France, and Belgium. NSA

N71-27235# International Nuclear Data Committee, Vienna (Austria).
CURRENT STATUS OF U-238 CAPTURE CROSS SECTION DATA IN THE NEUTRON ENERGY REGION 2keV TO 10 MeV
V. A. Konshin Mar. 1970 17 p refs
(INDC(NDS)-18/N) Avail: AEC Depository Libraries

The results of recent U-238 capture cross section measurements are evaluated. The following criteria were applied in analyzing the experimental results: greater weight was attached to new experimental results; the chosen U-238 capture cross section value was the one used as reference cross section for subsequent renormalization; the reference shape of the capture cross section curve was chosen; and data not in agreement with the reference shape of the curve was rejected. The weighted mean capture cross section value for U-238 at 30 keV was used as reference cross section value. Author (NSA)

N71-27236# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
SCHMIDT METHOD APPLIED TO SOLVING THE QUASIPOTENTIAL EQUATION
A. Atanasov 1971 8 p refs In RUSSIAN
(JINR-P2-5566) Avail: AEC Depository Libraries

The Schmidt method for solving the integral equations is applied to the quasi-potential equation. An analytical expression is obtained for the dependence between the coupling constant and the ground state for the system of two spinless particles interacting by the scalar meson exchange. Correction of the Born amplitude gives an approximation to the energies. Author (NSA)

N71-27239# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
FORWARD SCATTERING AMPLITUDE BEHAVIOR AT HIGH ENERGIES
O. A. Khrustalev, V. I. Savrin, and N. E. Tyurin 1969 10 p refs In RUSSIAN
(IFVE-STF-69-74) Avail: AEC Depository Libraries

On the basis of the unitarity condition the behavior of the forward scattering amplitude at moderately large energies is investigated. Besides the way in which the total cross section of hadron scattering reaches the asymptotical limit is studied. Author (NSA)

N71-27240# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
ON BEHAVIOR OF THE DIFFRACTION PEAK WIDTH AT HIGH ENERGIES IN THE CASE OF GAUSSIAN POTENTIAL

G. G. Volkov, M. A. Mestvirishvily, and G. L. Rchaulishvili 1969 6 p refs In RUSSIAN
(IFVE-STF-69-83) Avail: AEC Depository Libraries

The estimation of the diffractional peak width for scattering on the Gaussian type potentials is presented. Author (NSA)

N71-27241# Lyon Univ. (France). Inst. de Physique Nucleaire.
A STUDY OF ELASTIC ALPHA SCATTERING BY HE-4 WITH THE AID OF SEPARABLE NONLOCAL POTENTIALS [ETUDE DES DIFFUSIONS ELASTIQUES ALPHA SUR HELIUM-4 A L'AIDE DE POTENTIELS NON LOCAUX SEPARABLES]
Jacques Pigeon (Ph.D. Thesis) May 1970 89 p refs In FRENCH
(LYCEN-7041) Avail: AEC Depository Libraries

The (alpha,alpha) interaction is described in terms of nonlocal separable potentials. A formalism for the scattering of particles without spin and without internal structure was presented by considering nonlocal separable potentials in the presence of Coulombian potentials. This formalism was applied to the alpha elastic scattering by He-4 at energies between 0 and about 40 MeV. At higher energies absorption phenomena manifest themselves by the appearance of complex phase shifts. The introduction of internal structure effects satisfactorily explained experimental phase shifts remote from the 40 MeV region.
Author (NSA)

N71-27242# Lyon Univ. (France). Inst. de Physique Nucleaire.
DEVELOPMENT OF ION SOURCES FOR PARTICLE ACCELERATION BY VARIOUS INDIRECT METHODS [ELABORATION DE SOURCES D'IONS POUR L'ACCELERATION DE PARTICULES PAR DIFFERENTES METHODES INDIRECTES]
Theodore Tauth (Ph.D. Thesis) May 1970 72 p refs In FRENCH
(LYCEN-7027) Avail: AEC Depository Libraries

Ion sources were developed and constructed for particle acceleration by various indirect methods: heavy ions, associated particles, negative ions, and particles of given Z/A values. According to the type of accelerator, different axial or radial variants were developed. In order to understand the ion formation processes, the physics of the arc sources was studied and various quantitative relations between the most important parameters of the discharge obtained. The agreement between the calculations and experimental results was satisfactory. Phenomena such as cathode oscillation, which influence the discharge zone were studied. The behavior of the associated particles and the low binding energy ions during the acceleration were analyzed and loss mechanisms suggested.
Author (NSA)

N71-27243# Lyon Univ. (France). Inst. de Physique Nucleaire.
USE OF A VAN de GRAAFF GENERATOR TO SIMULATE THE TRANSIENT EFFECTS DUE TO RADIATION IN SEMICONDUCTORS [SIMULATION DES EFFETS TRANSITOIRES DES RAYONNEMENTS SUR LES SEMICONDUCTEURS A L'AIDE D'UN ACCELERATEUR VAN DE GRAAFF PULSE]
R. Gaillard, R. Genre, J. Guyon, and J. J. Samuell Jul. 1970 14 p refs In FRENCH
(LYCEN-7063) Avail: AEC Depository Libraries

An original simulation method was developed, which uses a Van de Graaff type proton accelerator to distinguish the transient effects induced in semiconductor devices by short intense pulses of ionizing radiation. The phenomena studied were the production of hole electron pairs. In order to achieve a valid simulation, it was necessary to use a beam focusing device capable of delivering a dose of at least 10 to the 9th power rads/s, and an appropriate pulsing device. The electronic circuit and the mechanical organization of the equipment are described. Problems involved in the observation and measurement of the pulsed proton current and the induced photocurrent in a bipolar transistor are examined in detail.
NSA

N71-27244# Deutsches Elektron-Synchrotron, Hamburg (West Germany).
DUAL MODEL FOR DIFFRACTIVE TWO-PION ELECTROPRODUCTION
A. Bartl and C. Iso Nov. 1970 10 p refs
(DESY-70/58) Avail: AEC Depository Libraries

A recent dual model for diffractive two pion photoproduction, treating the pomeron as having O positive structure, is generalized to two pion electroproduction. Taking into account gauge invariance and kinematical singularity free condition in a strict way, a cross section of rho meson production is obtained which is an order of magnitude higher than the experimental value. Author (NSA)

N71-27245# Naval Postgraduate School, Monterey, Calif.
THE MEASUREMENT OF TEMPERATURE DEPENDENT THERMAL NEUTRONS IN WATER USING A CRYSTAL DETECTOR
Robert Gordon Bennett (M.S. Thesis) Dec. 1970 121 p refs
(AD-720686) Avail: NTIS CSCL 18/11

The research was concerned with the temperature dependence of thermal neutron flux. In view of the excellent neutron detection capability exhibited by the Lithium Iodide Europium enriched crystal this phosphor was utilized for the investigation. A miniature crystal (4mm x 4mm) and a flexible light pipe combination was used to determine the neutron spatial distribution as a function of temperature using a Pu-Be source in a light-water medium. A separate experimental investigation, with Indium foils and activation analysis, was used to determine the temperature dependence of thermal neutron flux under the same experimental conditions as the crystal. A theoretical analysis was also conducted using Two-Group theory to obtain an expression for thermal flux with spatial and temperature dependent parameters. The results of the research indicate that the thermal neutron flux is temperature dependent in the region investigated (77 degrees - 168 degrees F). The experimental results verify the increasing trend of flux magnitude with increasing temperature, as predicted by the Two-Group solution.
Author (GRA)

N71-27246# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
DIGITAL MEASUREMENT OF THE PEAK CURRENT IN A LINEAR ELECTRON ACCELERATOR [MESURE DIGITALE DU COURANT CRETE D'UN ACCELERATEUR LINEAIRE D'ELECTRONS]
Georges Gourcy Dec. 1970 40 p refs In FRENCH
(CEA-N-1389) Avail: AEC Depository Libraries

In a linear electron accelerator, peak current values can be obtained from the peak voltage generated by an appropriate electron beam monitoring system. A target type monitor intercepts the electron beam whereas a ferrite type monitor does not affect the beam. A toroidal ferrite monitoring system and its associated digital equipment is described. It is shown that such a system is more accurate and reliable than the usual standard oscilloscope methods. Moreover, this system allows simultaneously the direct reading in current units, the recording in analog form and the sequential recording in digital form.
NSA

N71-27247# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
INVARIANTS IN THE NONRELATIVISTIC APPROXIMATION
V. N. Strel'tsov 1970 6 p refs In RUSSIAN
(JINR-P2-5363) Avail: AEC Depository Libraries

The procedure of proving the invariability of the known invariants of special theory of relativity in nonrelativistic and Galilean approximation is discussed.
Author (NSA)

N71-27248# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

IONIZATION COUNTER dE/dx FILLED WITH LIQUID XENON

Yu. V. Kulikov, N. I. Malashkevich, V. D. Ryabtsov, and E. A. Silaev 1970 8 p refs In RUSSIAN
(JINR-P13-5403) Avail: AEC Depository Libraries

The ionization counter dE/dx filled with liquid xenon is described. The sensitive area of the counter is equal to 50 sq cm, the depth of the recording layer of liquid xenon being t = 2 g/sq cm. The results of the counter testing in a negative pion beam at 6 GeV are presented. Author (NSA)

N71-27265# Rutgers Univ., New Brunswick, N.J. Dept. of Physics.

SOLUTIONS OF RELATIVISTIC DYNAMICAL INTEGRAL EQUATIONS Final Research Report, 1 Jan. 1969 – 1 Sep. 1970

Antonio Pagnamenta 15 Feb. 1971 8 p refs
(Grant AF-AFOSR-1668-69)
(AD-720867; AFOSR-TR-71-0546) Avail: NTIS CSCL 20/8

The report describes research under the contract in the area of numerical solutions to integral equations that arise in elementary particle theory. GRA

N71-27266# Rensselaer Polytechnic Inst., Troy, N.Y.

MONTE CARLO EVALUATION OF MULTIPLE SCATTERING AND RESOLUTION EFFECTS IN DOUBLE DIFFERENTIAL NEUTRON SCATTERING CROSS SECTION MEASUREMENTS

F. G. Bischoff, W. E. Moore (Knolls At. Power Lab.), and M. L. Yeater [1970] 64 p refs
(Contract AT(30-3)-328)
(RPI-328-211) Avail: NTIS

A Monte Carlo computer code MSC was developed which is equivalent to a three dimensional solution of the neutron transport equation for finite geometries. Resolution effects are calculated in detail. The MSC uses statistical weights as a means to improve the convergence of the Monte Carlo method by forcing scattering collisions; the statistical estimation technique allows every collision to contribute to every scattered energy and angular bin. Options were developed which treat rigorously the coherent and incoherent elastic scattering from polycrystals. Scattered energy and angle are sampled at each Monte Carlo collision by means of a method which samples alpha and beta from the scattering law. This sampling technique is exact within the framework of numerical integration and interpolation. It permits full kernel calculations, yet requires the storage of only two dimensional arrays. Good scattering results were obtained with relatively thick samples for several materials, notably water, polyethylene, and uranium carbide. Author (NSA)

N71-27275# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

APPLICATION OF THE O-18 (p,alpha) N-15 REACTION TO THE STUDY OF THE SELF-DIFFUSION OF OXYGEN IN URANIUM DIOXIDE [APPLICATION DE LA REACTION O-18 (p,alpha) N-15 A L'ETUDE DE L'AUTODIFFUSION DE L'OXYGENE DANS LE DIOXYDE D'URANIUM]

Emile Ligeon, Jean Fontenille, Andre Bontemps, and Pierre Contamin Nov. 1970 26 p refs In FRENCH
(CEA-R-4095) Avail: AEC Depository Libraries

A comparison between calculated and experimental spectra of alpha particles allowed low diffusion coefficients to be determined (D < or = 10 to the minus 13th power cm sq/sec). The following values of D were obtained: D = 10 to the minus 15th power cm sq/sec for UO2.000 at 650 C + or − 15; D = 9.3 × 10 to the minus 12th power cm sq/sec for UO2.009 at 400 C + or − 1; D = 9.6 × 10 to the minus 10th power cm sq/sec for UO2.12 at 600 C + or − 1. These results are in good agreement with those obtained with ion mass analyzer data. Author (NSA)

N71-27283# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

CONSTRUCTION OF A SEMIAUTOMATIC DEVICE FOR MEASURING NUCLEAR TRACKS. APPLICATION TO NEUTRON SPECTROMETRY AROUND THE LOW AND MEDIUM ENERGY ACCELERATORS AT SACLAY [REALISATION D'UN DISPOSITIF SEMIAUTOMATIQUE DE MESURE DES TRACES NUCLEAIRES. APPLICATION A LA SPECTROMETRIE DES NEUTRONS AUTOUR DES ACCELERATEURS DE BASSE ET MOYENNE ENERGIES DE SACLAY]

Romeo Delsaut Oct. 1970 91 p refs In FRENCH
(CEA-R-4063) Avail: AEC Depository Libraries

A semiautomatic device for analyzing nuclear emulsions was developed, which gives results used directly by a computer. The fixed emulsion was replaced by a mobile system of two emulsions perpendicular to each other. The validity of these methods was verified by measuring the spectrum of neutrons emitted by reaction D(d,n)He-3; the practical application is the determination of the spectrum of neutrons emitted by a plutonium fluorine source, and that of neutrons emitted in the Van de Graaff tandem chamber. The results obtained are very satisfactory and indicate that the two techniques proposed make it possible to widen the field of application of nuclear emulsions to the spectrometry of neutrons having an unknown incident direction, and also improve the conditions in which the emulsion is analyzed. NSA

N71-27284# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etude Nucleaires.

CESAR AND CONCORDE. APPLICATION OF THE CONCORDE HEXAGONAL SYNTHESIS PROGRAM TO EXPERIMENTS ON THE CESAR CRITICAL REACTOR [CESAR ET CONCORDE. UNE APPLICATION DU PROGRAMME DE SYNTHESE HEXAGONALE CONCORDE A UNE EXPERIENCE DANS L'EMPILEMENT CRITIQUE CESAR]

Hoan Nguyen-Ngoc and Serge Charbonneau (Electricite de France, Paris) Oct. 1970 40 p refs In FRENCH
(CEA-N-1276) Avail: AEC Depository Libraries

Three dimensional neutron diffusion equations can be solved by the method of synthesis whose essential advantages are the rapidity and the possibility of facing a great number of mesh points. This method was used for calculating the axial flux in a hexagonal reactor, the trial functions of two variables being furnished by the classical finite difference method. A comparison of the results given by such a calculation with measurements performed on the critical experimental facility Cesar are presented. Author (NSA)

N71-27285# Joint Inst. for Nuclear Research, Dubna (USSR).

ALPHA AND GAMMA DECAYS OF THE HIGH EXCITED STATES OF COMPLEX NUCLEI

V. G. Soloviev 1970 28 p refs
(JINR-E4-5135) Avail: AEC Depository Libraries

A possibility of obtaining information on the structure of the states of complex nuclei with excitation energies close to or higher than the nucleon binding energy from the experimental data on (n,alpha) and (n,gamma) reactions on resonances is studied. The wave function of the high excited state is constructed, and the matrix elements for the alpha and gamma transitions from the high excited states to the ground one-phonon and two quasi-particle ones are given. It is shown that the alpha and gamma transitions involve a small number of the components of the wave function of the high excited state. Therefore, the reduced probabilities data on alpha and gamma transitions may give information on the magnitude of definite type components of the wave functions of high excited states. Author (NSA)

N71-27286# California Univ., Berkeley. Lawrence Radiation Lab. Particle Data Group.
NN AND ND INTERACTIONS (ABOVE 0.6 GeV/c): A COMPILATION
Odette Benary, LeRoy R. Price, and Gideon Alexander (Tel-Aviv Univ.) Aug. 1970 358 p refs
(UCRL-20000-NN) Avail: NTIS HC$6.00/MF$0.95

There are 165 papers compiled reporting pp, np, nn, pd, and nd interactions from 0.5 to 70 GeV/c. Cross sections, angular distributions, and polarizations as well as fits to some of the data are displayed. Included are indices to the papers, as well as a complete listing of the selected data. Author (NSA)

N71-27289# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Radiochemie.
PLANNING AN ATOMIC BEAM APPARATUS FOR INVESTIGATION OF ELEMENTARY CHEMICAL PROCESSES OF NEUTRAL PARTICLES AT TRANSLATION ENERGIES FROM 0.1 TO ABOUT 20 eV (CHEMICAL ACCELERATOR) [PLANUNG EINER ATOMSTRAHLAPPRATUR ZUR UNTERSUCHUNG CHEMISCHER ELEMENTARPROZESSE VON NEUTRALTEILCHEN BEI TRANSLATIONSENERGIEN VON 0.1 BIS ETWA 20 eV (CHEMISCHER BESCHLEUNIGER)]
F. Schmidt-Bleek (Tenn. Univ., Knoxville), G. Stoecklin, and K. Vogelbruch Jul. 1970 51 p refs In GERMAN
(JUL-674-RC) Avail: AEC Depository Libraries

The construction of a very flexible atomic beam device for the study of chemical reactions in the eV range was studied by applying the technology developed in molecular beam technology to higher energies and supplementing this technology by radiochemical methods. The principal possibilities for the production of a monoenergetic beam of neutral particles in the eV range were investigated, and the solid-body sputtering method was selected because of its wider usable energy range and the greater number of elements possible for application. The design of an atomic beam device using solid-body sputtering as the radiation source is given. NSA

N71-27291# Oak Ridge National Lab., Tenn. Instrumentation and Controls Div.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF THE NEUTRON ENERGY EFFECTS ON REACTOR FLUCTUATION SPECTRA
Norbert Joseph Ackermann, Jr. (Ph.D. Thesis - Tenn. Univ.) Feb. 1971 128 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3245) Avail: NTIS

A two-energy group, one space point reactor kinetics model was developed using the Langevin conjecture. This model predicted no deviation from the one-energy group, point kinetics model in the frequency range of experimental interest except that the cross power spectral density (CPSD) between the two-energy groups was a complex valued function and that the thermal neutron lifetime could be determined directly from the slope of the curve for the tangent of the phase angle of that CPSD. A reactor noise experiment was performed to investigate these effects using an incore detector that was detecting thermal neutrons in the reactor core and an out-of-core detector that was detecting core fast leakage neutrons in the water shield. The auto power spectral density of the incore and out-of-core detectors and the CPSD between the two gave results which were in agreement within the experimental uncertainties. However, the tangent of the CPSD phase angle did not give a slope which agreed with the thermal neutron lifetime of the reactor. Author (NSA)

N71-27293# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
VISUALIZATION OF SPECTRA IN NUCLEAR PHYSICS. A PROGRAM SYSTEM ADAPTED TO GIVE A GRAPHICAL OUTPUT WITH A CII-90-10 COMPUTER [VISUALISATION DE SPECTRES EN PHYSIQUE NUCLEAIRE SYSTEME DE PROGRAMMES D'UN TERMINAL GRAPHIQUE ASSOCIE A UN CALCULATEUR CII-90-10]
Pierre Morvan Oct. 1970 57 p refs In FRENCH
(CEA-N-1383) Avail: AEC Depository Libraries

A general description of the visualization unit is given including the general design with the oscilloscope and analog and logic units, the generators of visual functions, the methods of associated dialog. Also a system of programs for the unit is described. NSA

N71-27297# Atomic Energy Establishment, Winfrith (England). General Reactor Physics Div.
THE MODIFICATIONS TO PERSEUS REQUIRED TO SOLVE HYDROGENOUS SYSTEMS
A. J. Clayton Oct. 1970 9 p refs Revised
(AEEW-M-952-Rev) Avail: AEC Depository Libraries

The main transport option in WIMS includes the collision probability method PERSEUS which incorporates PIP1 to solve the equations. Attempts to use WIMS with systems containing large amounts of hydrogen have incurred convergence troubles which could only be overcome by experimenting with the acceleration parameter. Apart from such experimenting being undesirable from the user point of view the resulting convergence has always been slow. Similar troubles have arisen in the hyperfine calculation, which also used PIP1. The cause of the poor convergence is due to the presence of negative self-scatter cross-sections introduced by the diagonal transport correction, and is worst in the hyperfine calculation because of the narrow groups and consequent small true self-scatter. The measures adopted in PERSEUS and the spectrum calculation to improve the convergence rate are described. Author (NSA)

N71-27302# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
INTERFERENCE OF IDENTICAL PARTICLES IN THE PROCESSES INVOLVING THE RESONANCES
V. G. Grishin, G. I. Kopylov, and M. I. Podgoretsky 1970 19 p refs In RUSSIAN
(JINR-P1-5315) Avail: AEC Depository Libraries

The interference of identical particles in the processes involving the resonances is considered; the possibility of measuring, on this basis, the widths of resonance states is duscussed. Author (NSA)

N71-27303# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
ON INELASTIC DIFFRACTIVE RHO-PHOTOPRODUCTION AND COMPTON SCATTERING
Guenter Wolf Sep. 1970 16 p refs
(DESY-70/48) Avail: AEC Depository Libraries

Inelastic diffractive neutral pion photoproduction was studied via diffractive rho-isobar production and double peripheral scattering. The integrated cross section was found to rise slowly with energy reaching approximately 3 micro-b at 20 GeV and approximately 4 micro-b at 100 GeV and approximately 15 exp (5.5t) at 10 GeV. The rho mass was predicted to shift in the same way as in the reaction gamma proton yields neutral pion proton. In addition a shift of the isobar mass was observed. The same procedure was used to estimate the differential cross section for inelastic diffractive Compton scattering on protons; d sigma/dt comes out to be approximately energy independent for E sub gamma greater than 5 GeV and of the order of 0.2 exp(8t) (micro-b/GeV sq). Author (NSA)

N71-27304# Joint Inst. for Nuclear Research, Dubna (USSR).
NONSTRANGE BARYON-BARYON RESONANCES
R. Ya. Zulkarneev and A. M. Rozanova 1970 10 p refs In RUSSIAN

(JINR-P2-5058) Avail: AEC Depository Libraries

Two peculiarities of the pp interaction mechanism in the region of 300 to 640 MeV are underlined. On the basis of the results of phenomenological analysis of pp scattering, performed under the assumption that in 1D2 and 3P2 states in pp-system there exists a strong absorption, it was established that this hypothesis is compatible with all the analyzed data on pp scattering and total cross sections at 640 MeV and does not contradict them. From consideration of energy dependence of the partial scattering amplitude by use of Argond diagrams, constructed on the basis of phase analysis, the possible existence of a resonance in the pp system (i.e. Y = B = 2) with mass 2050 + or − 90 MeV and J sup P = 2(+) is found. Attention is paid to the fact that the suggested hypothesis agrees with experimental data on energy dependence of the singlet pp scattering cross section at an angle of 90 deg (cms) which has a peak in the energy region of 300 to 550 MeV. However, for clearing up the nature of this peak both experimental and theoretical investigations are necessary. Author (NSA)

N71-27311# Institute of Nuclear Research, Warsaw (Poland).
HYPERNUCLEI AND HYPERNUCLEAR SPECTROSCOPY
J. Pniewski 1970 25 p refs
(INR-P-1223) Avail: AEC Depository Libraries

The review of experimental studies of hypernuclei covers identification, binding energies, and production of hypernuclei, spins, lifetimes, nonmesic and positive pion decays, and the Lambda hyperon nucleon interaction. Also discussed are excited and resonant states, hypernuclear isomers, and the gamma spectroscopy of hypernuclei. NSA

N71-27312# Kernforschungsanlage, Juelich (West Germany). Zentrallabor fuer Elektronik.
PULSE DISCRIMINATOR IN NUCLEAR ELECTRONICS [IMPULSDIVISIONSSTUFEN IN DER NUKLEAREN ELEKTRONIK]
Klaus Abend May 1970 23 p refs In GERMAN
(JUL-660-ZE) Avail: AEC Depository Libraries

The application of pulse discriminators to pulse form discrimination, particle identification, and measurement with position-resolving detectors is reviewed. Analog and digital discriminators are compared, and new circuit techniques are given. The comparison shows that with presently known discrimination methods, the discriminator with pure analog components is faster but more inaccurate than digital discriminators. NSA

N71-27328# Kernforschungszentrum, Karlsruhe (West Germany). Labor fuer Electronik und Messtechnik.
RESONATOR FOR X-BAND ELECTRON SPIN RESONANCE SPECTROSCOPY FOR SIMULTANEOUS MEASUREMENT AND ELECTRON RADIATION OF THE SAMPLE [EIN RESONATOR FUER DIE X-BAND-ELEKTRONEN-SPIN-RESONANZ-SPEKTROSKOPIE ZUR GLEICHZEITIGEN MESSUNG UND ELEKTRONENBESTRAHLUNG DER PROBE]
O. Mueller Sep. 1970 42 p refs In GERMAN; ENGLISH summary
(KFK-1285) Avail: AEC Depository Libraries

The design of a special resonator for electron spin resonance spectroscopy is described. It permits electron irradiation of the sample and measurement of the ESR signal simultaneously. In commercial ESR measurement resonators, sample measurements can be made only under irradiation with visible or ultra-violet light and with gamma quanta. However, in electron irradiation the magnetic field must be turned off, also, measurement and irradiation are possible only alternately. The measuring resonator described was designed for ESR measurement and electron irradiation of the sample at the same time. It permits the simultaneous production and measurement of free radicals during the process of irradiation. In two resonators of the H sub 102 mode of oscillation the frequencies were 9.428 Gc/s and 9.401 Gc/s, reaching a maximum Q of 4500. This development was carried out for ESR measurement of transient free radicals. Author (NSA)

N71-27337# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
EFFECT OF ALPHA UO3 IN THE PRODUCTION OF UO2 AND UF4 FROM BETA UO3 −0.05 H2O
Jacques Nicolas-Jarleton (Ph.D. Thesis − Paris Univ.) Dec. 1970 89 p refs In FRENCH
(CEA-R-4074) Avail: AEC Depository Libraries

Different crystalline UO3 phases were studied and the presence of hexagonal alpha UO3 in beta UO3-0.5 H2O confirmed. An X-ray diffraction method for determining the quantity of hexagonal UO3 in the beta UO3-0.5 H2O was developed. A comparative study was made of the kinetics of the NH3 reduction of the alpha and beta phases in UO3 and of the reactivity of UO2 with oxygen and hydrofluoric acid. The curves of reactivity of alpha and beta UO3 were established. The results were verified by three series of industrial tests using more than one metric ton of trioxide. The influence of the grinding process on the crystal structure (until it breaks), the absolute density, the specific surface, and the chemical reactivity of alpha UO3 and beta UO3-0.5 H2O are discussed. Author (NSA)

N71-27343 Carnegie-Mellon Univ., Pittsburgh, Pa.
ODD-EVEN STAGGERING OF NUCLEAR RADII
Balbir Singh Reehal (Ph.D. Thesis) 1970 114 p
Avail: Univ. Microfilms Order No. 70-9995

The odd-even staggering of nuclear radii in the isotope shifts of atomic and mu-atomic spectra is calculated using the pairing plus quadrupole model. The effect is explained on the basis that the mean square deformation beta squared associated with zero-point motion of quadrupole vibrations is greater for even than for odd nuclei. The radius change is related to a change in beta squared using the incompressible fluid model. The theoretical value of Delta beta squared is obtained by computing (Q squared) for even and for odd nuclei using for the even wave functions the BCS vacuum of the pairing force, with ground state correlations admixed in perturbation theory by the quadrupole force, using as intermediate states the Tamm-Dancoff phonons; and for the odd wave function a one quasi-particle state with ground state correlation admixtures properly blocked by the odd quasi-particle plus one quasi-particle coupled to one phonon. Near the end of the shell a one and two particle calculation is done. In addition, B(E2) transitions for odd mass nuclei and odd-even mass differences are also calculated. Dissert. Abstr.

N71-27344# Joint Inst. for Nuclear Research, Dubna (USSR).
PROBLEM OF TWO CENTRES IN QUANTUM MECHANICS. 5: ALGORITHM
L. I. Ponomarev and T. P. Puzynina 1970 42 p refs In RUSSIAN; ENGLISH summary
(JINR-P4-5040) Avail: AEC Depository Libraries

Algorithms for calculation of eigenvalues R sub i(R) and Lambda sub i(R) of the two center problem of quantum mechanics, its wave functions, and some matrix elements on these wave functions are described. Matrix elements were calculated for the Z sub 1 = 1; Z sub 2 = 1; 2 charge system and internuclear spacing R = 0.1(0.1)5(0.2)11 (0.5)20. Author (NSA)

N71-27345# Bhabha Atomic Research Centre, Bombay (India). Electronics Div.
A 14 MeV NEUTRON GENERATOR FOR CALIBRATION OF FAST NEUTRON DETECTORS
S. C. Misra and U. C. Gupta 1970 21 p refs
(BARC-499) Avail: AEC Depository Libraries

A 14 MeV neutron generator developed for the calibration

of fast neutron detectors is described. The constructional details and the performance of the generator are given. Some of the factors that affect the measurement of the neutron flux from the generator are discussed. Author (NSA)

N71-27347# Democritus Nuclear Research Center, Athens (Greece). Physics Dept.

NUCLEON AXIAL VECTOR FORM FACTOR AND SO(4,2) GROUP

E. Kyriakopoulos Apr. 1970 7 p refs

(DEMO-70/6) Avail: AEC Depository Libraries

Starting from the dynamical group SO(4,2) the nucleon axial vector form factor G sub A(t) is calculated. The expression G sub A(t) = G sub A(0)/(1-(t/M sub A sq))sq is found in agreement with the recent accurate determination of G sub A(t) from threshold electropion production. Author (NSA)

N71-27348# Bhabha Atomic Research Centre, Bombay (India).

LECTURES ON NUCLEAR CROSS SECTIONS

S. B. Garg and S. M. Lee, comp. 1969 86 p

(BARC/I-38) Avail: AEC Depository Libraries

A series of lectures intended to familiarize reactor physicists with the various techniques for calculating neutron cross sections are presented. The lectures include a review of nuclear cross section data, a review of nuclear reactions, Breit – Wigner theory, self-shielding and Doppler broadening of resonances, R-matrix theory, and the optical model. NSA

N71-27349# Bhabha Atomic Research Centre, Bombay (India).

OPTIMISATION OF CRYSTAL POSITIONS IN A MULTIDETECTOR-STRETCHER WHOLE BODY COUNTING ASSEMBLY: PROGRAM OCRYSP

R. K. Hukkoo and K. Unnikrishnan 1970 38 p refs

(BARC-505) Avail: AEC Depository Libraries

A semiempirical method is proposed to arrive at the best configuration of detectors for a multidetector-stretcher geometry for whole-body counters. The summed response of the geometry is predicted over the desired length of the stretcher and various criteria applicable to minimize the variation are discussed. Author (NSA)

N71-27360# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.

HANDLING OF FISSION PRODUCTS IN CALCULATION OF BURNUP WITH REGARD TO NEW NUCLEAR DATA APPLIED TO GRAPHITE REACTORS [ZUR BEHANDLUNG DER SPALTPRODUKTE IN ABBRANDRECHNUNGEN UNTER BERUECKSICHTIGUNG NEUER NUKLEARER DATEN ANGEWANDT AUF GRAPHITREAKTOREN]

Yosen Liu (Ph.D. Thesis – Tech. Hochschule, Aachen) Jul. 1970 248 p refs In GERMAN

(JUL-678-RG) Avail: AEC Depository Libraries

The nuclear data of all fission products were newly compiled and processed. The data thus obtained were used for an extensive study of reactor poisoning by fission products. An accurate evaluation of the reactor poisoning was made on the basis of the burnup calculations with consideration of the complete fission product decay schemes. Approximation versions for practical application were developed; these can be used for fuel cycle studies in thermal reactors. Author (NSA)

N71-27361# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerperforschung.

PSEUDORANDUM AND MARKOV SEQUENCES OPTIMIZING CORRELATION TIME OF FLIGHT SPECTROMETRY

F. Hossfeld and R. Amadori Jul. 1970 149 p refs

(JUL-684-FF) Avail: AEC Depository Libraries

The principles of the correlation method are summarized on the basis of a generalized theory yielding a gain factor from the comparison of the conventional time-of-flight technique with the correlation method. This gain factor depends on the structure of the time-of-flight spectrum, on the level of the unmodulated background, and on the duty cycle of the chopper sequence and thus can be used as a criterion for the optimization of the correlation experiments leading to optimum duty cycles. A comprehensive survey on the properties and the duty cycles of all classes of binary pseudorandom sequences so far known is given including the tables of all explicitly generated integer difference sets which are associated with the sequences interesting for time-of-flight applications. It is proved that binary pseudorandom sequences with coprime periods satisfy the conditions for the applications in the double correlation time-of-flight technique. Author (NSA)

N71-27369# Argonne National Lab., Ill.

PROMPT NEUTRON SPECTRA AND DELAYED NEUTRON SPECTRA FROM FISSION: SOME COMMENTS ON CURRENT KNOWLEDGE

Arthur H. Jaffey Nov. 1970 34 p refs

(Contract W-31-109-eng-38)

(ANL-7747) Avail: NTIS

Work on energy spectra of prompt and delayed fission neutrons is surveyed. The survey covers prompt-neutron spectra for U-235, U-233, Pu-239, Pu-241, U-238, and Th-232 irradiated by thermal and high-energy neutrons, and for spontaneous fission of Cf-252, Pu-240, Pu-242, and Cm-244. Although delayed neutron investigations have concentrated on U-235, these spectra are poorly known, with insufficient information for extrapolating to other nuclides. Further, reactor-dynamics calculations indicate that the spectral uncertainties can be important for reactor physics. Many measurements have been made of prompt-neutron spectra, but there is extensive disagreement (outside of statistical error) among these, most likely due to systematic errors in energy calibration of the neutron detectors. Though large shifts in the spectra used in calculations can have important effects in reactor physics, the actual spectra probably do not differ markedly from some average of existing results. Author (NSA)

N71-27370# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.

PRODUCTION, DETECTION, ANNEALING OF CRYSTAL LATTICE POINT DEFECTS BY NEUTRON IRRADIATION OF CERAMIC MATERIALS [ERZEUGUNG, NACHWEIS UND AUSHEILUNG VON KRISTALLGITTER-PUNKTDEFEKTEN DURCH NEUTRONENBESTRAHLUNG VON KERAMISCHEN WERKSTOFFEN]

W. Dienst 14 Jul. 1970 176 p refs In GERMAN; ENGLISH summary

(KFK-1215) Avail: AEC Depository Libraries

The production of point defects and displacement spikes by collision processes is described as well as the corresponding lattice-site exchanges and the site exchanges due to ionization and temporary overheating in the neighborhood of fission fragment paths. Other subjects considered are the point-defect concentration in equilibrium between defect production and recovery and the formation of point-defect clusters. An estimation of the enhancement of diffusion processes in the lattice caused by the increase in point defect concentration and the lattice-site exchange-frequency under irradiation is included. The estimate shows that a measurable increase in the diffusion rate as a result of irradiation can be expected especially for ceramic fuels. It could possibly result in an enhancement of diffusion-induced creep which might be described with a modified Nabarro – Herring-model. Author (NSA)

N71-27379# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.

EXPERIMENTAL PHONON PHYSICS Progress Report, 1 Apr. 1970 – 31 Mar. 1971

R. O. Pohl, J. A. Krumhansl, and A. J. Sievers 31 Mar. 1971

16 p refs
(Contract AT(30-1)-2391)
(NYO-2391-126) Avail: NTIS

Summaries are given of the experimental research in the following: second sound and heat pulses in solids, cooperative phenomena in dilute systems of electric dipoles, thermal properties of glasses, far infrared properties of impurity modes and metals, and infrared instrumentation. E.H.W.

N71-27380 California Inst. of Tech., Pasadena.
CURRENT COMPUTERS IN QUANTUM ELECTRODYNAMICS, 1. ELECTROMAGNETIC MASS DIFFERENCES OF THE PSEUDOSCALAR MESON AND BARYON OCTETS, 2
Thomas Andrew Nagylaki (Ph.D. Thesis) 1970 96 p
Avail: Univ. Microfilms Order No. 70-12492

The operator structure of the singular terms in the equal time commutator of space and time components of the electromagnetic current is investigated in perturbation theory by establishing a connection with Feynman diagrams. It is made very plausible that the singular term is a c number. An SU(3) symmetric multi-channel calculation of the electromagnetic mass differences in the pseudoscalar meson and baryon octets is carried out with an attempt to include some of the physics of the crossed channel along the lines of the recent work by Bell and Zachariasen. The importance of the tensor meson Regge trajectories is emphasized.
Dissert. Abstr.

N71-27381# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
THREE DIMENSIONAL MONTE CARLO CALCULATION (TRIPOLI CODE) OF THE NEUTRON SPECTRA IN THE LOWER SHIELD OF PHENIX [CALCUL PAR UNE METHODE DE MONTE CARLO A TROIS DIMENSIONS (CODE TRIPOLI) DU SPECTRE DES NEUTRONS DANS LA PROTECTION INFERIEURE DE PHENIX]
Jean-Claude Nimal and Therese Vergnaud Oct. 1970 40 p refs In FRENCH
(CEA-N-1359) Avail: AEC Depository Libraries

Results of calculations made on the lower part of the PHENIX reactor using the TRIPOLI code are presented. These calculations represent the first step towards the lateral calculations intended to determine the secondary sodium activation. The case considered is practically two dimensional and involves very strong attenuation of the neutron fluxes. For a similar case, calculations were made in spherical geometry using the NIOBE code. Author (NSA)

N71-27382# Idaho Nuclear Corp., Idaho Falls.
SCANS: SPECTRA CALCULATION FROM ACTIVATED NUCLIDE SETS
M. H. Putnam and G. E. Putnam Nov. 1970 23 p refs
(Contract AT(10-1)-1230)
(IN-1446) Avail: NTIS

The SCANS program determines the fast- and thermal-neutron flux levels from Co-58 and Co-60 disintegration rates, given the irradiation history of the reactor in which the activities were produced in Ni and Co wires. The program processes up to 50 pairs of disintegration rates per problem; hence, all the data from a pair of irradiated wires monitored at a number of corresponding positions can be handled. The major features of the method are that the irradiation histroy (flux versus time) of the samples can be of arbitrary complexity and that absorption depletion of the nuclides in the transition schemes is automatically taken into account.
Author (NSA)

N71-27383# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
INVESTIGATION OF THE Be-9(t,n) B-11 REACTION AT 1.10 MeV
K. Malczynska, K. Niedzwiedziuk, M. Przytula, and V. I. Salatskii 1970 8 p refs In RUSSIAN
(JINR-P15-5148) Avail: AEC Depository Libraries

The angular distributions of neutrons from the Be-9(t,n)B-11 reaction at 1.10 MeV were measured for four groups of neutrons corresponding to the ground, first, second, and sixth levels of B-11. The expansion coefficients of the angular distributions over the Legendre polynomials are given. It is observed that in the investigated reaction at 1.10 MeV a notable contribution from the compound nucleus mechanism is not excluded. Author (NSA)

N71-27384# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
ANALOG COMPUTER FOR CALCULATING THE RATIO OF AMPLITUDE OF TWO PULSES [CALCULATEUR ANALOGIQUE DU RAPPORT DES AMPLITUDES DE DEUX IMPULSIONS]
Max Moroni and Marcellin Rogerieux Jun. 1970 28 p refs In FRENCH
(CEA-N-1314) Avail: AEC Depository Libraries

This computer, including two logarithmic amplifiers connected at the terminal inputs of an adder, is used for neutron–gamma discrimination in a neutron spectrometer with a recoil proton proportional counter. The various electronic circuits and some experimental results are presented. NSA

N71-27385# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
OXIDATION OF URANIUM CARBIDES IN GASEOUS ENVIRONMENTS [L'OXYDATION DES CARBURES D'URANIUM PAR DES REACTIFS GAZEUX].
Georges Matcheret Nov. 1970 19 p refs In FRENCH
(CEA-Bib-183) Avail: AEC Depository Libraries

The reaction mechanisms and the oxidation kinetics of uranium carbides in various gaseous environments, namely oxygen, water vapor, carbon dioxide and carbon monoxide are described.
Author (NSA)

N71-27386 Texas A&M Univ., College Station.
A MODEL NEUTRON DEUTERON SCATTERING CALCULATION ABOVE THE INELASTIC THRESHOLD
Jerry Glen Webb (Ph.D. Thesis) 1969 61 p
Avail: Univ. Microfilms Order No. 70-11589

The problem of three distinguishable spinless particles interacting by means of a short range central potential is considered. The initial state is specified to be a free particle incident on a bound state of the other two with enough energy to create a three free particle final state. The elastic scattering amplitude in this energy region is calculated by means of the Kohn variational principle. The trial wave function used has a number of linear parameters and one nonlinear parameter. For the most complicated trial function used containing seventeen linear parameters and a range of values for the nonlinear parameter, it was not possible to produce a converged result, although evidence of convergence was present. Dissert. Abstr.

N71-27408# Institute of Nuclear Physics, Kracow (Poland).
AUTOMATED SYSTEMS AND ELECTRONICS FOR THE KRAKOW-DUBNA SLOW NEUTRON INVERTED GEOMETRY SPECTROMETER KD SOG-1 [AUTOMATYKA I ELEKTRONIKA KRAKOWSKO-DUBIENSKIEGO SPEKTROMETRU NEUTRONONEGO ODWROTNEJ GEOMETRII KD SOG-1 (PROJEKT)]
Jadeusz Zaleski and Januss Sokolowski 1970 15 p refs In POLISH; ENGLISH summary
(INP-727) Avail: AEC Depository Libraries

The spectrometer for microdynamics of condensed matter, operating at the IBR-30 pulsed reactor at the Joint Institute for

Nuclear Research in Dubna (USSR), is described. Special emphasis is placed on the problem of automation and remote control of the spectrometer kinematics and detection systems and of the physical experimental conditions. Author (NSA)

N71-27409# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaire.

RADIOACTIVE CHARACTERISTICS NECESSARY FOR STUDYING FISSION PRODUCTS: BETA RADIATION AND CONVERSION ELEMENTS [EXTRAITS DES CARACTERISTIQUES RADIOACTIVES NECESSAIRES POUR L'ETUDE DES PRODUITS DE FISSION: RAYONNEMENT BETA ET ELECTRONS DE CONVERSION]

S. Kostic and R. Le Meur 6 Aug. 1970 26 p refs In FRENCH
(CEA-N-1372) Avail: AEC Depository Libraries

In order to use them in semiconductor spectrometry, the energies of the electrons emitted by fission products were grouped in two tables. The first table refers to the electrons emitted in beta disintegration and the second to the internal conversion electrons emitted. The name and period of the nuclide are indicated for each energy. The energies and their associated abundances are given. Author (NSA)

N71-27410# Oak Ridge National Lab., Tenn.

RADIATION SAFETY PRACTICES: OPERATION HENRE

H. M. Butler and F. F. Haywood Apr. 1970 34 p refs Sponsored by AEC
(CEX-65-05) Avail: NTIS

During 1967 an experiment was conducted at the Nevada Test Site using a high-yield-neutron generator supported at several elevations on a 1527-ft steel tower. Numerous personnel radiation hazards were associated with the routine operation of this generator, and specialized equipment and procedures were required. The most notable hazard resulted from handling targets for the generator, each of which contained 1500 to 2000 Ci of He-3. Handling was required for target fabrication, packing and shipping, mounting onto generator, removal and transfer to storage, and disposal of wastes. Area monitoring and biosampling techniques, internal-dose estimation, and specific procedures for limiting personnel exposure are included. Author (NSA)

N71-27411# United Kingdom Atomic Energy Authority, Harwell (England). Atomic Energy Research Establishment.

CONCERNING THE HALF LIFE OF Ce 144

M. J. Cabell and M. Wilkins Sep. 1970 3 p refs
(AERE-R-6529; EANDC(UK)-130AL) Avail: AEC Depository Libraries; UK 1s 2d; BIS $0.30

An evaluation of published data leads to the conclusion that the half-life of Ce-144 is 284.4 + or − 0.4 days. Author (NSA)

N71-27412# Japan Atomic Energy Research Inst., Tokyo.

STUDY ON THE RADIATION INDUCED CHAIN CROSSLINKING AND CROSSLINKING POLYMERIZATION

Tsutomu Kagiya, Hiroshi Mitsui, Miyuki Hagiwara, Fumio Hosoi, and Katsuhiro Yamaji Sep. 1970 118 p refs In JAPANESE; ENGLISH summary
(JAERI-Memo-4147) Avail: AEC Depository Libraries

The effects of acetylene on the gamma-induced crosslinking of polyethylene were investigated from the viewpoint of the changes in the solubility and structure of polymer, and of the amount of hydrogen formation. As a result, a chain mechanism of radiation-induced crosslinking of polyethylene was proposed. From the results of studies on energetics of this mechanism, the gamma-induced chain crosslinking of polyethylene was studied in the presence of the gaseous mixtures of monomers containing fluorine and acetylene. In addition, the results applied the mechanism to the chain crosslinking polymerization of methyl methacrylate are also reported. Author (NSA)

N71-27413# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

GENERALIZED DWBA MODEL APPLIED TO THE Mg-24(d,p)Mg-25 REACTION AT Ed = 13.6 MeV

H. Schulz, H. J. Wiebicke, R. Fuelle, D. Netzband, and K. Schlott 1970 28 p refs
(JINR-E4-5350) Avail: AEC Depository Libraries

By the code POLLUX angular distributions for the reaction Mg-24(d,p)Mg-25 were calculated and compared with the experimental data covering the 5/2 positive [202], 1/2 positive [211], 1/2 positive [200], and 1/2 negative [330] rotational bands. The code considers indirect transitions arising via intermediate rotational excitations of the target and final nuclei. The optical and deformation parameters for both the entrance and exit channels were taken from the elastic and inelastic scattering data. The wave function of the transferred neutron was obtained in a deformed Saxon−Woods potential. Remarkable agreement is obtained for the stripping-forbidden transition to the positive 7/2, 5/2 [202] state. Author (NSA)

N71-27414 Florida Univ., Gainesville.

A MOLECULAR BEAM INVESTIGATION OF THE DISSOCIATION OF NITROUS OXIDE ON TUNGSTEN

Robert N. Coltharp (Ph.D. Thesis) 1969 64 p
Avail: Univ. Microfilms Order No. 70-11738

The angular characteristics of the reflection and dissociation of N2O on tungsten using a modulated molecular beam of N2O incident on the surface at an angle 50 deg from the normal were studied. The surface used was found to be polycrystalline consisting of parallel (112) planes. A quadrupole mass spectrometer was rotated about the tungsten target to determine the spatial distribution of both the N2O and the products of dissociation. The N2 and NO distributions were found to be diffuse in the range where dissociation occurs. This implies that they remain on the surface for sufficient periods of time for thermal equilibrium to be achieved. Attempts to find other products such as oxygen and nitrogen atoms as well as various tungsten oxides were unsuccessful. Dissert. Abstr.

N71-27415# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etude s Nucleaires.

ELECTRONIC PROPERTIES OF ACTINIDE CARBIDES AND NITRIDES [CONTRIBUTION A L'ETUDE DE LA STRUCTURE ELECTRONIQUE DES CARBURES ET NITRURES D'ACTINIDES]

Charles-Henri de Novion (Ph. Thesis − Paris Univ., Orsay France) Dec. 1970 153 p refs In FRENCH
(CEA-R-4113) Avail: AEC Depository Libraries

Measurements were made on the following properties: magnetic susceptibilities of ThN, UN, U2C3, NpC sub 0.95, NpN, U(C sub 1−xN sub x), (U sub x Th sub 1−x)N; electrical resistivities of NpN, U2C3, U(C sub 1−xN sub x); specific heat (between 1.3 and 10 K) of ThN, UN, U(C sub 1−xN sub x), YN, (Y sub 0.94 U sub 0.06)N. The results are discussed from two points of view: random and localized 5 f2 electrons. The calculated crystal field effect with a localized 5 f(2) configuration gave the right order of magnitude for the specific heat anomaly of UN at 52 K. The electronic specific heat, magnetic susceptibility (at 4 K), and residual resistivity for U(C sub 1−xN sub x) carbonitrides are maxima for x = 0.88 (concentration for which the long range antiferromagnetic order at 0 K disappears): it is probably a paramagnon effect. NSA

N71-27416# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

PROBLEM OF QUASIPOTENTIAL SMOOTHNESS IN QUANTUM FIELD THEORY MODELS

B. M. Barbashov, S. P. Kuleshov, V. A. Matveev, A. N. Sissakian,

and A. N. Tavkhelidze 1970 9 p refs
(JINR-E2-5365) Avail: AEC Depository Libraries

An interpretation of the smooth complex quasipotential is given in the framework of the eikonal consideration of quantum field theory models. Author (NSA)

N71-27417 Florida Univ., Gainesville.
CRYSTAL ELECTRIC FIELD PROPERTIES OF SOME Tm-SALTS MEASURED BY DIFFERENTIAL gamma-gamma ANGULAR CORRELATION TECHNIQUE
Ugur Ortabasi (Ph.D. Thesis) 1969 189 p
Avail: Univ. Microfilms Order No. 70-12252

A series of time differential perturbed gamma-gamma angular correlation (PAC) measurements have been performed with the gamma-decay cascades of the Tm-169 nucleus bound in several different ionic hydrated cyrstal environments: YbCl3·6H2O, Yb(NO3)3·6H2O and Yb(ClO4)3·9H2O. A fully automatic Ge(Li-NaI(Tl) slow-fast coincidence system was used. All measurements were performed at room temperature and with polycrystalline point sources. In all cases studied, cyclic patterns were obtained for the time dependent anisotropy. The analysis of the cyclic behavior yielded quadrupole couplings and asymmetry parameters characteristic of the chemical nature of the sources and permitted the calculation of the total electric field gradient for each chemical complex and other relevant crystal field parameters. Dissert. Abstr.

N71-27418 Virginia Univ., Charlottesville.
PION CAPTURE ON CARBON 12 WITH EMISSION NEUTRON PAIRS
David Lynn Cheshire (Ph.D. Thesis) 1969 67 p
Avail: Univ. Microfilms Order No. 70-8094)

The energy spectra of neutron pairs from the C-12(negative pion,2n)B reaction have been measured. The B-10 excitation energy spectrum yields approximate energies for the residual two hole states. Single neutron energy spectra for fixed excitation energies are used to test the theoretical treatment of the final state interaction. The data disagree with the theory for pion capture from 2P atomic states but agrees well for capture from 1S atomic states. Dissert. Abstr.

N71-27434# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
X-RAY SPECTROMETRY USING Si(Li) DIODES. RESULTS RECENTLY OBTAINED AT THE GENERAL ELECTRONICS DEPARTMENT REACTOR ELECTRONICS SERVICE [SPECTROMETRIE X AVEC Si (Li). RESULTATS ACTUELS ORTENUS AU D.E.G./S.E.R.]
A. Friant, R. Gras, A. Lorin, and C. Saliou 30 Oct. 1970 18 p refs In FRENCH
(CEA-N-1401) Avail: AEC Depository Libraries

The development of a very low noise preamplifier with optoelectronic negative feedback is described. Its field effect transistors are mounted on special ceramic bases and have led to a significant improvement in the resolution obtainable in nondispersive X-ray spectrometry using the very low capacity Si(Li) detectors developed in the laboratory. The principal parameters of the assembly are indicated and the results obtained given: with 6 keV photons the electronic and nuclear resolutions were respectively 110 and 165 eV. Author (NSA)

N71-27435# California Univ., Berkeley. Lawrence Radiation Lab.
SEMICONDUCTOR DETECTORS IN HIGH-ENERGY PHYSICS
Clyde E. Wiegand Sep. 1970 20 p refs Presented at Intern. Conf. on Instrumentation for High Energy Phys., Dubna, USSR
(Contract W-7405-eng-48)
(UCRL-20042; CONF-700902-6) Avail: NTIS

An outline of the present state of the development of semiconductor detectors and how they are being used in experiments at high energy accelerators is given. NSA

N71-27436# Sandia Corp., Albuquerque, N.Mex.
TOTAL CROSS SECTION FOR SINGLE ELECTRON LOSS BY Ne AND Ar IN NITROGEN, OXYGEN, AND AIR
Grant J. Lockwood Nov. 1970 22 p refs Sponsored by AEC
(SC-RR-70-735) Avail: NTIS

Measurements of the total cross section for electron stripping of Ne and Ar in N2, O2, and air are reported in the energy range 25 to 90 keV. For all combinations the cross sections were observed to increase with increasing velocity. The dependence of the electron stripping cross section on the neutralizing gas was measured by charge exchanging the ions in N2 or air and their parent gas. In all cases studied, the values of electron stripping for neutrals formed in their parent gas were less than or equal to the value of electron stripping for neutrals formed in N2 or air. As expected, the cross section electron stripping for Ne in air was found to equal 80% of electron stripping for Ne in N2 plus 20% of electron stripping for Ne in O2. Author (NSA)

N71-27437# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
OBSERVATION AT VERY LOW TEMPERATURES OF THE ANNEALING PROCESS IN SPECIMENS WITH RADIATION DEFECTS [LE RECUIT DES DEFAUTS CREES PAR IRRADIATION OBSERVE A TRES BASSE TEMPERATURE]
A. Bourret 1970 2 p refs In FRENCH Presented at the 7th Intern. Congr. on Electron Microscopy, Grenoble, France, 30 Aug.–5 Sep. 1970
(CEA-CONF-1681; CONF-700809-3) Avail: AEC Depository Libraries

A platinum microscope cooled to 10 K was used to study the annealing of specimens in which defects were created by neutron irradiation. The specimens were in the form of thin foils and had received a dose of 4×10 to the 18th power nvt at an energy in excess of 1 MeV. The absence of visible defects in Fe at 77 K indicated that the depleted zones were not directly visible and that at that temperature no mobile species had yet diffused. The visible observation of faults at 77 K in Ni, Al, and Mg indicated that they were produced by agglomeration of the interstitials during the neutron irradiation. The loops rearrange themselves until a vacancy-type fault becomes mobile. This fault then destroys the loops in the case of Al and Mg (because the vacancies are then highly dispersed: strong stage 3) or as in the case of Ni begins to partially annihilate them (because of the very inhomogeneous way in which the vacancies are already grouped: weak stage 3). NSA

N71-27439 Boston Coll., Chestnut Hill, Mass.
DISPERSION RELATIONS OF TEFLON
Victor Edgar Lagarde, III (Ph.D. Thesis) 1969 199 p
Avail: Univ. Microfilms Order No. 70-13216

Atomic and molecular motions within oriented polytetrafluoroethylene (PTFE) are studied by means of slow neutron inelastic scattering. These motions are due to inter- and intra-molecular forces for which constants are defined and evaluated within a Born von-Karman force model. A knowledge of these forces leads directly to the set of dispersion relations, which can be used to express the quantized energy associated with the elastic waves in the PTFE structure. The dispersion relations are sensitive functions of the force constants; an exact and unique calculation of the force constants is achieved by iterating them to force the theoretical dispersion relations to match those regions determined experimentally by the neutron data and by published Raman and infrared data. Dissert. Abstr.

N71-27440# Deutsches Elektronen-Synchroton, Hamburg (West Germany).
PHOTOPRODUCTION OF PION PAIRS WITH HIGH INVARIANT MASS
H. Alvensteben, U. J. Becker, William K. Bertram, M. Chen, K. J. Cohen et al Nov. 1970 10 p refs Prepared in cooperation

with MIT, Cambridge, Mass.
(DESY-70/61) Avail: AEC Depository Libraries

The yield of pion(+) pion(−) pairs from the reaction gamma + C yields C + pion(+) pion(−) in the invariant mass region 0.6 < m < 1.8 GeV/c sq was measured. The result, based on 100,000 events, shows that the data, at high energy and very small momentum transfer, exhibit an enhancement in the region 1.3 < m < 1.8 GeV/c sq. Author (NSA)

N71-27441# Kernforschungszentrum, Karlsruhe (West Germany).
IDENTIFICATION OF ELEMENTS 102 AND 104 WITH THE HELP OF THE COLLIMATION METHOD
Yu. Ts. Oganesyan et al [1970] 23 p refs Transl. into GERMAN from the Russian report In GERMAN
(KFK-TR-329; JINR-P7-4797) Avail: AEC Depository Libraries

The sharp contrast of the reactions and properties of the element 104 synthesized at Dubna and Berkeley was outlined. Possible errors in the identification of the isotope produced at Berkeley were discussed. The synthesis of elements 102 and 104 was repeated at Dubna using a°collimation method for the identification of the elements. The results obtained agreed with the previous Dubna results. The collimation method of identification is described in detail and it was recommended that the measurement of the integral angular distribution of the nuclear reaction products permits a reliable identification of the atomic number of an element. This method is very easy in the synthesis of new elements in reactions with accelerated heavy ions. NSA

N71-27442# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON THE USE OF K-HARMONICS IN THE SCATTERING PROBLEMS
O. Lkhagva 1970 15 p refs In RUSSIAN
(JINR-P4-5366) Avail: AEC Depository Libraries

It is suggested to use the method of hyperspherical functions for obtaining the lower bounds on the scattering parameters, as well as for the generalization of the time delay theory for the case of the reactions with the fragment number N > or = 3. Author (NSA)

N71-27443# Joint Inst. for Nuclear Research, Dubna (USSR).
METHOD FOR PULSED POLARIZED ION BEAM PRODUCTION FOR HIGH-ENERGY ACCELERATORS
E. D. Donets and Yu. A. Plis 1970 9 p refs In RUSSIAN
(JINR-P9-5446) Avail: AEC Depository Libraries

A method for the atomic beam ionization with the storage of polarized ions in the electron beam and their pulsed extraction during the capture time of the accelerator is proposed. It is shown that a confined charge is equal approximately to 2 × 10 to the 11th power ions for the ionizer 20 cm long. Estimates for the phasotron with spatial variation of the magnetic field, designed in the Laboratory of Nuclear Problems, show that the external polarized proton beam will be equal approximately to 0.5 microangstrom, which is 400 times the value for the polarized proton beam produced by the scattering at the target. Author (NSA)

N71-27444# Joint Inst. for Nuclear Research, Dubna (USSR).
ACCELERATION AND EXTRACTION OF THE DEUTERONS FROM THE JINR PROTON SYNCHROTRON
A. M. Baldin, Yu. D. Beznogikh, L. P. Zinovev, I. B. Issinskii, G. S. Kazanskii et al 1970 8 p refs In RUSSIAN
(JINR-P9-5442) Avail: AEC Depository Libraries

In August 1970 the works were completed on improvement of the linear accelerator and high-frequency systems of the JINR PS which allowed the previously suggested regime of deuteron acceleration at momentum of 11 GeV/c to be realized. The accelerated deuteron beam has been extracted from PS and physical experiments were started. Author (NSA)

N71-27445# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
A POTENTIAL HIGH ENERGY RESOLUTION IODINE NEGATIVE ION SOURCE
Ronald L. Cowperthwaite and Howard Myers 1 Nov. 1970 19 p refs
(Contract F19628-70-C-0134)
(AD-720671; AFCRL-70-0643; SR-2) Avail: NTIS CSCL 7/4

The dissociative attachment reaction e + HI to H + I(-) is suggested as a source of I(-) ions. The desirable characteristics of the source are: (1) large attachment cross section, (2) small value of the H/I mass ratio, (3) nearly thermoneutral attachment, and (4) insensitive to the electron beam energy spread. When formed from stationary HI, these factors combine to give an I(-) energy spread of 2-3 millivolts. The dominant I(-) spread results from the thermal motion of HI, and is estimated to be 0.03 - 0.06 eV, FWHM. By using the heavy I(-) ion to bombard a stationary light target molecule, a large difference in laboratory and center-of-mass (CM) energy scales further improves energy resolution and calibration. The reaction I(-) + H2 to H2(-) + I is suggested for measuring the electron affinity of H2. For this case, the energy scale compression factor is 64.5 and the energy spread in the CM system, due to the I(-) spread, is estimated to be the order of one millivolt. Author (GRA)

N71-27446# Academy of Sciences (USSR), Moscow. Inst. Atomnoi Energii.
EFFECT OF DELAYED NEUTRONS ON THE DYNAMIC REACTIVITY OF A REACTOR ORIGINATING DURING OSCILLATIONS OF THE DENSITY OF THE FUEL [VLIYANIE ZAPAZDYVAYUSHCHIKH NEITRONOV NA DINAMICHESKUYU REAKTIVNOST REAKTORA, VOZNIKAYUSHCHUYU PRI KOLEBANIYAKH PLOTNOSTI GORYUCHEGO]
V. L. Blinkin and V. M. Novikov 1970 23 p refs In RUSSIAN; ENGLISH summary
(IAE-1955) Avail: AEC Depository Libraries

Delayed neutrons influence upon the alteration of the reactivity in reactor due to the fuel density oscillations is investigated. It is shown that the calculations taking into account the delayed neutrons do not lead to the change of the sign of the resulted reactivity. However, the dynamic reactivity dependence upon the delayed neutrons parameters essentially differs from that for the constant supercriticality. The dynamic reactivity of the system with delayed neutrons may be even more than that calculated for the system without delayed neutrons. Author (NSA)

N71-27450# Scientific Research Atomic Reactor Inst., Melekess (USSR).
CALCULATION OF THE EFFECTIVE FRACTION OF DELAYED-NEUTRONS AND OF THE LIFETIME OF INSTANTANEOUS-NEUTRONS FOR FAST CRITICAL ASSEMBLIES [RASCHET EFFEKTIVNOI DOLI ZAPAZDYVAYUSHCHIKH NEITRONOV I VREMENI ZHIZNI MGNOVENNYKH NEITRONOV DLYA BYSTRYKH KRITICHESKIKH SBOROK]
M. N. Zizin and L. N. Yaroslavtseva 1969 27 p refs In RUSSIAN
(SRARI-P-53) Avail: AEC Depository Libraries

The methods of prompt-neutron mean lifetime and an effective delayed-neutron fraction calculation are given. Calculations for a series of critical assemblies in P sub 1 and S sub n approximations are carried out. Calculation results are compared with the experimental data obtained on the fast critical assemblies. Author (NSA)

N71-27451# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
PULSE SHAPER WITH THE ZERO TIME OF REGENERATION FOR THE APPARATUS BLOCKING AT THE LARGE

LOADING

L. Ondrish, S. V. Mukhin, S. V. Rikhvitskii, I. N. Semenyushkin, P. Khorvat et al 1970 12 p refs In RUSSIAN

(JINR-P13-5377) Avail: AEC Depository Libraries

A pulse shaper with zero regeneration time is described and the results of its test are presented. The amplitude and duration of the trigger pulses are not less than 0.3 V at 50 ohm and 10 ns respectively. The output pulse duration is fixed at 150, 350, 800, and 1600 microseconds; the amplitude is 1 V at 50 ohm. The polarities of the trigger and output pulses are negative. The shaper was used in the blocking schemes for elimination of the pulse pile-up at the large loading. Author (NSA)

N71-27452# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

STUDY OF ACTIVATION ANALYSIS USING CHARGED PARTICLES AND gamma PHOTONS [CONTRIBUTION A L'ETUDE DE L'ANALYSE PAR ACTIVATION AU MOYEN DES PARTICULES CHARGEES ET DES PHOTONS gamma]

Charles Engelmann (Ph.D. Thesis - Paris Univ.) Oct. 1970 222 p refs In FRENCH

(CEA-R-4072) Avail: AEC Depository Libraries

In order to study gamma photon activation, a study was first made of the influence of conversion targets on the activities induced by irradiating C and Ag monitors behind Al, Cu, and Pt targets of various thicknesses. Using C and Ag monitors, a determination was made of the spatial distribution of the bremsstrahlung for Al and Pt targets irradiated with 25- to 45-MeV electron. The (gamma,n) activation curves and the interference curves arising in the determination of C, N, and F by (gamma,t) and (gamma,alpha n) reactions on neighboring elements were determined. Examples are given of the determination of light elements in very pure materials, in particular boron determination in silicon at a concentration of 0.0001 microgram/g and nitrogen determination at a concentration of 0.01 microgram/g in iron and niobium. NSA

N71-27453# College de France, Paris. Lab. de Physique Atomique et Moleculaire.

POLOLOGY, FACTORIZATION, AND UNITARITY [POLOLOGIE, FACTORISATION ET UNITARITE]

M. Benayoun and Ph. Leruste Jul. 1970 22 p refs In FRENCH; ENGLISH summary

(PAM-70-7) Avail: AEC Depository Libraries

Factorization theorems were proven with the only hypotheses of extended unitarity and T-invariance, generalizing in this way the factorization of the residue theorem and the dipole coefficient factorization of Rebbi and Slanski. The weak Levinson condition was shown to imply restrictions on S, T and K matrices. The hypotheses underlying the one or many level Breit-Wigner formula were clearly established. The link between poles of the K-matrix and zeros of the D-function was exhibited, and the arbitrariness in the choice of phase space factors was somehow analyzed. NSA

N71-27454 Brown Univ., Providence, R.I.

DECAY MODES OF THE ETA MESON

Burton Nathaniel Kendall (Ph.D. Thesis) 1969 116 p

Avail: Univ. Microfilms Order No. 70-8744

A determination of the decay branching ratios of the eta meson into 2 gamma, neutral pion gamma gamma, 3 neutral pions, positive pion negative pion neutral pion, and positive pion negative pion gamma is reported. The etas are produced in the reaction negative pion + proton yields neutral eta + neutron with several incident pion momenta in the range 737.5 Mev/c to 769.5 Mev/c. Counters and optical spark chambers were used to detect the reaction and decay particles. Dissert. Abstr.

N71-27455# Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).

A MODULAR PROGRAM SYSTEM FOR EXPERIMENTAL PROGRAMING FOR THE PDP-9 [EIN MODULARES PROGRAMMIERSYSTEM ZUR EXPERIMENT-PROGRAMMIERUNG FUER DIE PDP-9]

K. H. Degenhardt, L. Frevert, and W. Woletz Jul. 1970 82 p refs In GERMAN

(HMI-B-96) Avail: AEC Depository Libraries

A programming system for nuclear physics experiments controlled by a digital computer is described. Programs are generated by a preassembler program which takes macro instructions and prefabricated subroutine calls out of a library and places parameters into them which the user has been asked for. Each type of macro instruction is represented by a special flow chart symbol. Thus programs can be generated in dialog by using flow charts only. Author (NSA)

N71-27456# Connecticut Univ., Storrs. Dept. of Physics.

A COINCIDENCE STUDY OF ATOMIC COLLISIONS Final Report, 1 May 1968 - 31 Jan. 1971

Howard C. Hayden 31 Jan. 1971 12 p refs

(Grant AF-AFOSR-1570-68)

(AD-720882; AFOSR-TR-71-0545) Avail: NTIS CSCL 7/4

The work concerned atomic collisions of the type X(+) + Y yields X(+m) + Y(+n) + (m+n-1)e at keV energies (T(o)) and large scattering angles. Of interest are the inelastic energy (Q) distributions, and average ionization probabilities P(mn) for the many combinations for the collision partners investigated. The systems studied were the Ar(+)- Ar, Ne(+,++,o)- Ne, N(+)- Ar, and Ar(+)- Kr cases. The neon case was studied at 200 keV to test Lichtens prediction that the fast electron ejection intensities should be in the ratio of 0:1:2 for incident neutrals, singly charged ions and doubly charged ions respectively. The Ar(+)- Ar case was recently studied to show that the inner shell vacancy leading to Auger electron emissions can be caused by promotion of an electron to a bound state of the ion. The N(+)- Ar and Ar(+)- Kr cases were studied in great detail in order to see if one could, for example, predict Ar(+)- Kr result on the basis of previous Ar(+)- Kr and Kr(+)- Kr data. A statistical model similar to that of Everhart and Kessel has been developed for these cases. Author (GRA)

N71-27457# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

PLASMA FORMATION BY DISSOCIATION OF AN ACCELERATED HYDROGEN CLUSTER BEAM

F. Bottiglioni, J. Coutant, and M. Fois 1970 4 p refs Presented at 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 31 Aug. - 4 Sep. 1970

(CEA-CONF-1610; Conf-700817-6) Avail: AEC Depository Libraries

The dissociation rate of a hydrogen cluster beam crossing an electron target was calculated with a model involving spontaneous breaking of multicharged clusters. Author (NSA)

N71-27458# Central Research Inst. for Physics, Budapest (Hungary).

CALCULATION OF RESONANCE INTEGRALS: CODE RIFFRAFF AND RAO4

Z. Szatmary and A. Bagyinszki 24 Jun. 1970 11 p refs

(KFKI-70-12-RPT) Avail: AEC Depository Libraries

Codes RIFFRAFF and RAO4 calculate resonance integrals and homogenized cross sections for the multigroup slowing down code GRACE. RIFFRAFF calculates the space energy variation of the flux in a cylindrical two region cell. RAO4 calculates average cross sections in homogeneous mixtures of nuclei on the basis of a very simple physical model. Both codes are written in Fortran for the ICT-1905 computer. Author (NSA)

N71-27459# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

THE 500 kV THETA PINCH PROJECT [PROJEKT 500

KV-THETA-PINCH]
G. Herppich Nov. 1969 38 p refs In GERMAN; ENGLISH summary
(IPP-4/68) Avail: AEC Depository Libraries

The designed theta pinch with a four times fed coil will be driven by Blumlein-type transmission lines (0.58 Omega). The lines generate a 125 kV pulse of 500 ns length with a rise time constant of 85 ns. The corresponding field is 5.5 kG. The Blumlein lines are resonance charged by a capacitor bank and the start switches are pressurized multichannel spark gaps. The bias field bank consists of two parts. One part is connected directly with the coil like the main bank. The other part feeds into two single-turn coils left and right of the main coil in order to produce a homogeneous field even 20 cm outside the main coil. Two smaller Blumlein lines were built for studying technical and physical properties.
Author (NSA)

N71-27460 Kentucky Univ., Lexington.
ANGULAR CORRELATION AND GAMMA RAY BRANCHING RATIO STUDIES OF Ar 40
Ralph L. Place (Ph.D. Thesis) 1969 187 p
Avail: Univ. Microfilms Order No. 70-12387

Properties of the 2.53-MeV and 3.21-MeV levels of Ar-40 were studied by means of angular correlation measurements of the proton-proton-gamma and gamma-gamma types. In addition, the gamma-ray branching characteristics of the second through seventh excited levels of Ar-40 were measured by means of proton-gamma coincidence techniques. The correlation studies of the 2.53-MeV level show that at an incident proton energy of 5.21 MeV the reaction proceeds mainly via J sup pi = 5/2(+) level in the intermediate compound nucleus, Ar-41. The channel spin mixing ratio for the inelastically scattered proton leading to the 2.53-MeV levels is −0.88. The gamma ray amplitude mixing ratio for the de-excitation, 2.53-MeV yields 1.46-MeV has been determined as 0.24. The spin of the 2.53-MeV level is assigned J = 2.
Dissert. Abstr.

N71-27461# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
MEASUREMENT AND ANALYSIS OF THE CAPUTRE TO FISSION CROSS SECTION RATIO alpha FOR Pu 239 BETWEEN 20 keV AND 500 keV [MESURE ET ANALYSE DU RAPPORT alpha DE LA SECTION EFFICACE DE CAPTURE A CELLE DE FISSION POUR LE PLUTONIUM 239 ENTRE 20 keV ET 500 keV]
Andre Lottin Nov. 1970 12 p refs In FRENCH
(CEA-N-1368) Avail: AEC Depository Libraries

The ration alpha = sigma sub c/sigma sub f of Pu-239 exhibited a negative slope with respect to the incident neutron energy between 20 and 500 keV. The energy of the 1+ transition state explaining this slope was calculated, assuming a Hill and Wheeler fission barrier. It was 250 + or − 50 keV above the neutron binding energy assuming h omega = 500 keV.
NSA

N71-27462# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
COMPLICATION OF THE NUCLEAR STATE STRUCTURE WITH INCREASING EXCITATION ENERGY
V. G. Soloviev 1970 30 p refs
(JINR-E4-5469) Avail: AEC Depository Libraries

The tendency towards the complication of the structure of nuclear states and the growth of their density with increasing excitation energy is demonstrated by a simple model. It is shown that the description of the excited states by means of the wave functions containing few- and many-quasi-particle components is efficient for the study of their structure. The behavior of the s-neutron strength function depending upon the mass number A is explained without recourse to the optical model. It is shown that the experimental data on the reduced alpha widths give evidence on the structure of highly excited states.
Author (NSA)

N71-27463# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
NONROTATIONAL STATE OF PERFORMED NUCLEI WITH AN ODD NUMBER OF NEUTRONS IN THE RANGE 165 < OR = A < OR = 175
L. A. Malov, V. G. Solovev, and S. I. Fedotov 1970 14 p refs In RUSSIAN
(JINR-P4-5228) Avail: AEC Depository Libraries

A superfluid nuclear model was used for calculating the ground and excited states of odd N nuclei in the range of 165 < or = to A < or = to 175. The single particle energies and wave functions of the Saxon–Woods potential were used in the computations. Data obtained were in good agreement with experimental data.
Author (NSA)

N71-27464# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
AN IMPROVEMENT TO THE QUANTUM YIELD OF THE PHOTOCATHODES OF THE 56 TVP PHOTOMULTIPLIERS IN THE RED PART OF THE SPECTRUM (7000 A) [AMELIORATION DU RENDEMENT QUANTIQUE PHOTOCATHODIQUE DES PHOTOMULTIPLICATEURS 56 TVP DANS LE ROUGE (7000 A)]
M. Hesse and O. Tittel Dec. 1970 23 p In FRENCH
(EUR-CEA-FC-576) Avail: AEC Depository Libraries

The point sensitivity of a photomultiplier was examined. When illuminated with monochromatic radiation (6900 A), a three fold variation in sensitivity across the surface was observed. The use of an improved light input system compared to the normal central method led to a seven fold improvement in sensitivity.
Author (NSA)

N71-27465# Central Research Inst. for Physics, Budapest (Hungary).
INTRODUCTION TO THE CURRENT-CURRENT THEORY OF THE WEAK INTERACTION
A. Frenkel 1970 88 p refs
(KFKI-70-24-HEP) Avail: NTIS

The status of the modern current-current theory of weak interactions is reviewed, and its predictions are compared with experimental results in elementary particle physics. The strangeness conserving weak decays, leptonic decays of hadrons, the isotriplet vector current theory, and the Cabibbo octet current theory are considered. Also the nonleptonic weak decays and the PCAC hypothesis are discussed.
NSA

N71-27466# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Medizin.
DOSIMETRY OF INCORPORATED TRITIUM AND I 125 [DOSIMETRIE VON INKORPORIERTEM TRITIUM UND JOD-125]
Herald H. Ertl Aug. 1970 27 p refs In GERMAN
(JUL-668-ME) Avail: AEC Depository Libraries

Exact calculation of dose distribution is only possible for a point source with exponential absorption. In the case of beta emitters, these conditions are not valid. It can be shown, however, that the exponential absorption function can be approximated satisfactorily by dividing the energy spectrum into 18 channels of 1 keV, each of which can be treated as a monoenergetic electron source. With this method, the dose distributions from tritium and I-125 point sources are calculated. Also computed is the energy absorbed within a certain radius and the energy escaping this radius.
NSA

N71-27469# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
NUCLEAR MAGNETIC RESONANCE AT 310 MHz IN A SUPERCONDUCTING SOLENOID [RESONANCE MAGNETIQUE NUCLEARIRE A 310 MHZ DANS UN SOLENOIDE SUPRA-CONDUCTEUR]

Jean-Jacques Dunand (Ph.D. Thesis–Grenoble Univ.) Nov. 1970 104 p refs In FRENCH
(CEA-R-3855) Avail: AEC Depository Libraries

The development of a NMR spectrometer with a superconducting magnet is discussed in the first section. The methods used to obtain the most homogeneous magnetic field and to minimize the sources of error due to the spectrometer are described. The second section is devoted to the study of elastomers and free nitroxide radicals. The elastomers exhibited a variation in transition temperature with respect to the magnetic field. The large paramagnetic shifts enabled a complete study by NMR of piperidinic and pyrrolidinic nitroxide free radicals to be made. Author (NSA)

N71-27472 Yeshiva Univ., New York.
ON QUANTIZATION OF INTERACTING COVARIANT MASSLESS FIELDS WITH PRESCRIBED ASYMPTOTIC NULL DATA
Joseph Klerfeld (Ph.D. Thesis) 1969 100 p
Avail: Univ. Microfilms Order No. 70-11607

A covariant field theory is derived using the Lagrangian formalism for interacting massless fields with prescribed asymptotic null initial data at past null infinity, i.e., the incoming radiation fields. For noninteracting massless fields the incoming radiation fields and their commutation relations on a past null infinity hypersurface determined the field and the commutation relations at any finite points in space-time uniquely. Using the covariant perturbation expansion of the fields in powers of the coupling parameter and the retarded Green's function it was found that the interacting fields and their commutation relations are determined by the incoming radiation fields and their commutation relations at past null infinity. The commutation relations of the interacting fields are functionally dependent on the fields; they vanish for any two points in space with a space-like separation. It is believed that the dynamical theory of the massless fields, which is Lorentz covariant and causal, can be quantized. Dissert. Abstr.

N71-27473# California Univ. Livermore. Lawrence Radiation Lab.
AN INTEGRATED SYSTEM FOR PRODUCTION OF NEUTRONICS AND PHOTONICS CALCULATIONAL CONSTANTS. VOLUME 9: THRESHOLDS OF NUCLEAR REACTIONS INDUCED BY NEUTRONS, PHOTONS, PROTONS, DEUTERONS, TRITONS, AND ALPHA PARTICLES
Robert J. Howerton 24 Sep. 1970 304 p refs
(UCRL-50400-Vol-9) Avail: NTIS HC$6.00/MF$0.95

The thresholds for nuclear reactions induced by neutrons, photons, protons, deuterons, tritons, and alpha particles are tabulated. The threshold of a reaction is defined to be the minimum kinetic energy of an impinging particle such that the reaction is energetically possible. Thus, a nonzero threshold exists only if the Q-value of the reaction is negative and all exoergic reactions have zero thresholds. It is often useful to have ready reference to the Q-values of exoergic reactions so the negative of the Q-value is entered in the tables for such reactions. Author (NSA)

N71-27508 World Meteorological Organization, Geneva (Switzerland).
OZONE TRANSMISSION AND EMISSION AT 9.6 MICRONS COMPUTED FROM ADJUSTED THEORETICAL LINE DATA
Renate Rest *In* WMO Radiation including Satellite Tech. 1970 p 161–163 (See N71-27484 15-13)
Copyright. Avail: Issuing Activity

The comparison between spectra obtained in the laboratory and computed spectra demonstrated the necessity for correction of line data, especially in the long-wave band. It is assumed that the discrepancies resulted from the stretching of the molecule due to centrifugal forces. An attempt is made to correct the line intensities by a factor dependent on the rotational number. ESRO

N71-27573 Cornell Univ., Ithaca, N.Y.
THE RATIO OF NEGATIVE TO POSITIVE PIONS IN FORWARD PION PHOTOPRODUCTION
Algimantas Ramanauskas (Ph.D. Thesis) 1970 137 p
Avail: Univ. Microfilms Order No. 70-17643

The ratio of sigma (photon deuteron yields pion (−) proton proton)/sigma(photon deuteron yields pion(+) neutron neutron) where theta is zero degrees was measured as a function of incident photon energy between 600 and 1700 MeV. A triple focusing magnet spectrometer was used to detect the forward going pion. Electron contamination was eliminated by placing about one radiation length of material at the first focus as well as using a gas Cerenkov anti-counter in conjunction with an optical shower spark chamber. The measurement of the pion(−)/pion (+) ratio and the well-known measurements of the photon proton yields pion(+) neutron cross section in the forward direction were used to determine the isoscalar and isovector pion photoproduction amplitudes in the exact forward direction, as a function of energy. A substantial isoscalar contribution which varied rapidly with energy was found in the region between 600 MeV and 1300 MeV. The values of isovector pion photoproduction amplitude were compared with predictions obtained from fixed-t dispersion relations and fairly good agreement was found for energies below 900 MeV. Measurements of the pion(−)/pion(+) ratio which were corrected for final state Coulomb effects were used to find the forward cross section for pion(−) photoproduction from a free neutron target. Dissert. Abstr.

N71-27574 Fordham Univ., New York.
NON-RELATIVISTIC TIME-DEPENDENT SCATTERING THEORY FOR LONG RANGE POTENTIALS
Denis Wren Mark Mulherin (Ph.D. Thesis) 1969 190 p
Avail: Univ. Microfilms Order No. 70-11443

The nonrelativistic scattering of two spinless particles a time-dependant formalism is discussed. A time-dependent theory applicable to the Coulomb potential lambda/r is developed and a physical interpretation of U sub s (−)(0) in terms of a nonvanishing source-target interaction is proposed. Dissert. Abstr.

N71-27575 Wisconsin Univ., Madison.
THE SCATTERING AND BREAKUP OF VECTOR POLARIZED DEUTERONS ON HELIUM
Leon Gregory Keller (Ph.D. Thesis) 1970 123 p
Avail: Univ. Microfilms Order No. 70-8300

Vector polarized deuterons from a tandem accelerator were used to measure the vector analysing power in the elastic scattering of deuterons from He-4. Data were taken at nine deuteron energies from 3 to 11 MeV, in steps of 1 MeV, for center-of-mass angles between 22 deg and 152 deg. Prominent peaks in the angular distributions were seen at all energies and an increase in the complexity of the angular distributions was observed with increasing deuteron energy. A phase shift analysis was carried out at each energy and it was found that particle waves up to F-waves were required to reproduce the data above 8 MeV. Only the two well known D-wave resonances were seen. The P-wave phase shifts were found to be small. The asymmetry of protons from the breakup of the polarized deuterons was measured at 8.5, 10, and 11 MeV deuteron energy for laboratory angles between 17.8 deg and 88.2 deg. A modified distorted wave calculation was carried out at 10 MeV deuteron energy. Dissert. Abstr.

N71-27576# Bhabha Atomic Research Centre, Bombay (India).
NUCLEAR PHYSIC DIVISION Annual Report, 1969 – 1970
P. K. Iyengar, N. S. Satya Murphy, eds. 1970 112 p
(BARC-501) Avail: AEC Depository Libraries

Research at the nuclear physics division includes nuclear physics, solid state physics, reactor neutron physics, seismology, and development of special nuclear instruments. NSA

N71-27577 Maryland Univ., College Park.
GANTMAKHER-KANER OSCILLATIONS AND CYCLOTRON DAMPING OF HELICON WAVES IN INDIUM
James Francis Carolan, Jr. (Ph.D. Thesis) 1969 151 p
Avail: Univ. Microfilms Order No. 70-12916

Measurements were made with the magnetic field direction, z, perpendicular to the (001), (100), (110) and (111) crystal planes. For the (001) and (111) planes a structure in the Doppler shifted cyclotron resonance absorption was observed in the form of a helicon propagation window. The window results from a gap in the delta A/delta k sub z curve, where A is the area of an orbit in the plane perpendicular to z. For the (001) excellent agreement was observed with the Fermi surface given by the orthogonalized plane wave parameters. The dispersion relation was calculated assuming the Fermi surface to be cylindrically symmetric about the magnetic field direction, and reasonable agreement with the observed dispersion was obtained. The (110) plane represented a little different type of edge in that delta A/delta k sub z at the edge was peaked sharply. In the (001) case the oscillation was observed to change period abruptly as a function of the magnetic field. The period of the oscillations just below the helicon edge did not correspond to the extremal value of delta A/delta k sub z expected. The surface impedance was calculated numerically, which reproduced approximately the observed period and duplicated the switching from one period to another. Dissert. Abstr.

N71-27578 Florida Univ., Gainesville
EXPERIMENTAL STUDIES OF CHARGE TRANSFER COLLISIONS
Grayson Hanks Rayborn, Jr. (Ph.D. Thesis) 1969 107 p
Avail: Univ. Microfilms Order No. 12578

The energetics of charge transfer collisions of low energy Ar(+) ions with H2, D2, and CO2 molecules were investigated in ion-beam gas-scattering experiments. For Ar(+) − H2, the observed ions appear to have been produced via the single channel, Ar(+)(2P3/2) + H2 = Ar(1S0) + H2(+)(V = 1). The results for Ar(+) − D2 were strikingly different, however. In this case, at least two exothermic channels contribute to the observed product ion currents. The qualitative difference in the observed Q-distributions for the Ar(+) − H2 and Ar(+) − D2 cases may have bearing on the disparity between total cross-section measurements for the two systems. The charge transfer between Ar(+) and CO2 produces energetic ions some of which have at least a full eV of kinetic energy. These energetic ions may explain anomalies observed in previous photoionization mass spectrometer experiments. Results of the experiment with Ar(+) − H2 collision indicate that ions may be formed in known vibrational levels. Dissert. Abstr.

N71-27579 Rochester Univ., N.Y.
BACKWARD K(+) P ELASTIC SCATTERING BETWEEN 1.0 2.5 BeV/c
Stuart K. Tewksbury (Ph.D. Thesis) 1969 227 p
Avail: Univ. Microfilms Order No. 70-2916

The backward elastic K(+) cross sections for $-1 \leq \cos\theta_{cm} < -.7$ with incident kaon laboratory momenta between 1.0 and 2.45 BeV/c, at intervals of approximately 0.1 BeV/c, were measured in the separated beam of the alternating gradient synchrotron. Binned in cos theta sub cm intervals of 0.02, the distributions had a statistical uncertainty of 10%. A backward peak was seen at incident momenta above 1.8 BeV/c which became sharper at higher energies. The 180 deg cross section fell off with increasing s (center of mass energy squared) as d sigma/d Omega infinity s to the minus 4th power, with no prominent structure other than three shoulders, at 1.2, 1.5, and 2.0 BeV/c. The distributions were interpreted in terms of Reggeized baryon exchange and indicated that exactly degenerate Lambda alpha and Lambda gamma poles provide a better fit to the data than any single dominant pole. Dissert. Abstr.

N71-27580# Illinois Univ., Urbana.
VACANCY MIGRATION ENERGY IN ALUMINUM: A DETERMINATION BY NUCLEAR MAGNETIC RELAXATION
Cherng-Yuan Sun Feb. 1971 144 p refs
(Contract AT(11-1)-1198)
(COO-1198-801) Avail: NTIS

The activation energy for vacancy migration was determined, at each base-line (equilibrium) temperature setting, from the ratio of the mean time between successive atomic jumps in the specimen under thermal equilibrium conditions and that immediately after pulsed heating. The value obtained was 0.58 eV with the standard deviation of 0.04 eV in the temperature range from 260 C to 310 C. At higher temperatures, however, the measured values of the activation energy exhibit a variation with temperature. The temperature dependency was explained as being primarily associated with the generation of vacancies during the experiment. The generation rates are estimated from supplementary experiments and the effects of vacancy generation are analyzed. From the data taken under equilibrium conditions, the activation energy for self-diffusion is determined to be 1.32 eV with the estimated standard deviation of 0.02 eV in the temperature range from 240 C to 500 C; the pre-exponential factor is 0.144 sq cm/sec with the estimated error limit (not the standard deviation) of 0.003 sq cm/sec. Author

N71-27581# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
MEASUREMENT AND ANALYSIS OF HOLMIUM TOTAL CROSS SECTION FOR NEUTRONS AT ENERGIES BETWEEN 0.005 AND 1.7 keV [MESURE ET ANALYSE DE LA SECTION EFFICACE TOTALE DE L'HOLMIUM POUR DES NEUTRONS D'ENERGIE COMPRISE ENTRE 0.005 ET 1.7 KEV]
Henry Tellier Nov. 1970 20 p refs In FRENCH
(CEA-N-1338) Avail: AEC Depository Libraries

The total cross section of holmium was measured by the time-of-flight method, at liquid nitrogen temperature. Resonance parameters were obtained by a shape analysis of the transmission curve. The values of the strength function, the level-density parameter, and the neutron-width and level-spacing distributions were determined. Author (NSA)

N71-27583# Commissariat a l'Energie Atomique, Grenoble (France). Centre d-Etudes Nucleaires.
DEVICES AND TECHNIQUES FOR CHARACTERIZATION OF MINERALS. CHARACTERIZATION OF COMPOUNDS AND MATERIALS BY NEUTRON DIFFRACTION [APPAREILLAGES ET TECHNIQUES DE CARACTERISATION DES COMPOSES MINERAUX. CARACTERISATION DE COMPOSES ET DE MATERIAUX PAR DIFFRACTION NEUTRONIQUE]
A. Decapeime and E. F. Bertaut [1969] 21 p refs In FRENCH
Presented at the Conf. on Chem. of the Solid State, Grenoble, France, 12 Dec. 1969
(CEA-CONF-1500; Conf-691213-1) Avail: AEC Depository Libraries

The properties of the neutron and the different reactions that it produces with a nonnegligible probability are summarized briefly as an introduction to the characterization of minerals by neutron diffraction. The characterization of compounds and materials is illustrated by concrete examples of the location of light atoms with great precision, the determination of the magnetic order, characterization of the ionic or covalent state of a chemical bond, and the determination of the charge transfer in such bonds, and spin density. NSA

N71-27584# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
SELF DIFFUSION, UNDER HYDROSTATIC PRESSURE, OF BODY CENTERED CUBIC Pu [AUTODIFFUSION SOUS PRESSION HYDROSTATIQUE DU PLUTONIUM CUBIQUE

CENTRE]
Jean-Andre Cornet and Daniel Calais 1970 14 p refs In FRENCH Presented at meeting on Met., Paris, 1970
(CEA-CONF-1690; Conf-700941-2) Avail: AEC Depository Libraries

The activation volume for the self-diffusion of Pu epsilon phase (bcc) was determined using the hydrostatic pressure parameter. Samples containing different quantities of Pu-240 were studied. The activities of the faces of the sample, in the 17 keV range (L conversion line of uranium) were compared using a 400 channel scintillation detector. In the first approximation the D = f(P) sub T curves reveal an exponential increase in the diffusion coefficient D with respect to pressure. This unusual result and the low value of the activation enthalpy characterize this phase as being abnormal from the point of view of diffusion. The activation volume Delta V = −4.9 cu cm is 34 per cent of the molar volume. In order to explain this result it is necessary to introduce the following hypothesis: that atoms in the epsilon phase are subjected to a modification in their electronic structure, which gives to them the same valence as in the liquid phase. Thus their displacement into interstitial positions in octahedral sites of bcc phase can take place with a negative activation volume and a small activation enthalpy.
Author (NSA)

N71-27607 Nevada Univ., Reno.
FINITE NUCLEAR SIZE CHARGE MODEL EFFECTS IN THE SMALL ANGLE MULTIPLE SCATTERING OF HIGH ENERGY ELECTRONS
Lonnie Dean Spight (Ph.D. Thesis) 1970 239 p
Avail: Univ. Microfilms Order No. 70-12980

The modification of the small angle multiple scattering distribution of high energy electrons due to the finite size of the charge distribution of target nuclei was determined as an additive correction term to the Moliere point nucleus multiple scattering solution. The Mott single scattering cross section used in the small angle approximation form was modified by multiplicative factors to account for atomic electron shielding and the finite size of the target nuclei. Inelastic and scattering effects produced by the atomic electrons were incorporated into the definition of the multiple scattering characteristic angle; inelastic nuclear effects are taken into account by a multiplicative factor to the elastic form factor. Four different methods of evaluating the nuclear correction term for general form factors were established. Detailed calculations are presented for seven specific form factors including Gaussian, hollow Gaussian, Yukawa 2 exponential, modified exponential, and hollow exponential 1 and 2.
Dissert. Abstr.

N71-27614# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STUDY OF THE alpha AND epsilon PHASES OF Pu BY USING HIGH-HYDROSTATIC PRESSURES [CONTRIBUTION A L'ETUDE DES PHASE alpha ET epsilon DU PLUTONIUM PAR L'UTILISATION DES HAUTES PRESSIONS HYDROSTATIQUES]
Jean-Andre Cornet (Ph.D. Thesis—Paris Univ.) Nov. 1970 97 p refs In FRENCH
(CEA-R-4092) Avail: AEC Depository Libraries

Large grains of Pu in the alpha phase were prepared by using high hydrostatic pressures. A mechanism is proposed in order to explain the self diffusion properties in the alpha phase. Under pressure, the phase change method is better than the discontinuous growth method to obtain large grains of the alpha phase (section approximately 9 sq mm). However, the substructure remains important. The self diffusion coefficients in the epsilon phase increase exponentially with pressure; the activation volume is negative and of the order of 34 percent of the molar volume. This result is not very consistent with a vacancy mechanism, but it can be interpreted with a mechanism of activated interstitials with the same electron configuration as plutonium atoms in the liquid state.
Author (NSA)

N71-27615 Wisconsin Univ., Madison.
SCATTERING AND REACTIONS OF POLARIZED PROTONS AND DEUTERONS FROM BERYLLIUM
David Heron Loyd, Jr. (Ph.D. Thesis) 1970 181 p
Avail: Univ. Microfilms Order No. 70-8307

A polarized beam from a tanden Van de Graaff accelerator was used to measure the azimuthal asymmetry of the reaction products produced by polarized protons and deuterons incident on a Be-9 target. The analyzing power (i.e., the azimuthal asymmetry when a reaction is initiated by a completely polarized beam) was deduced from the measured asymmetry and the known beam polarization. An optical model analysis was performed of the polarization in elastic scattering and of previously measured elastic scattering cross sections. The optical model was found to reproduce the data only for incident proton energies of 9.0 MeV or greater. An optical model analysis was performed of the deuteron vector polarization data at 9.0 MeV. Distorted Wave Born Approximation (DWBA) calculations were made for comparison with the (d,p), (d,t) and some of the (p,d) data; only the (d,p) ground state reaction was well reproduced by DWBA.
Dissert. Abstr.

N71-27623 Pittsburgh Univ., Pa.
ELECTRON CAPTURE AND LOSS IN COLLISIONS OF HEAVY IONS WITH ATOMIC OXYGEN BELOW 2 MEV; A NOVEL EXPERIMENTAL APPROACH TO STUDY ELECTRON IMPACT EXCITATION OF THE 2P STATE OF HELIUM ION
Hsi Hu Lo (Ph.D. Thesis) 1969 157 p
Avail: Univ. Microfilms Order No. 70-11818

Electron capture and loss cross sections for various gases (N(+), O(+), Ar(+), Kr(+), and Xe(+) and metallic (Al(+), K(+), Fe(+), Ba(+), and Ba(++) ions in collisions with atomic oxygen have been measured in the energy range 30 keV to 2 MeV. Beam-in-static-gas techniques were employed. Ions formed by an electron impact ion source were mass selected by a RF quadrupole mass filter and were accelerated by a Van de Graaff accelerator into a fast, well collimated ion beam. This ion beam was then steered through an atomic oxygen target chamber developed to provide a collision region containing thermally dissociated oxygen atoms in the ground state. The charge states of the emerging fast ion beam were measured and used to deduce the electron capture and loss cross sections of the particular fast heavy ion on neutral atomic oxygen. In another experiment, the electron impact excitation of He(+) to the 2P state was studied.
Dissert. Abstr.

N71-27627 Virginia Univ., Charlottesville.
RESONANCE FLUORESCENCE IN Cd AND Ni USING NEUTRON CAPTURE GAMMA RAYS
Guy Phillips Estes (Ph.D. Thesis) 1969 162 p
Avail: Univ. Microfilms Order No. 70-8060

The nuclear resonance fluorescence technique was used to study three highly excited nuclear energy levels in cadmium and nickel isotopes employing neutron capture gamma rays as the exciting radiation. The use of a high resolution Ge(Li) detector to observe the decay of the excited levels clarified results obtained in previous poor resolution studies, improved accuracy in the branching ratio measurements, and allowed previously unobtainable information on level spins and photon multipolarities to be obtained.
Dissert. Abstr.

N71-27628# Atomic Energy Commission Research Establishment, Riso (Denmark).
THERMAL NEUTRON SPECTROSCOPY USING POSITION SENSITIVE DETECTORS TOGETHER WITH FOURIER CORRELATION TIME OF FLIGHT AND SINGLE CRYSTAL TECHNIQUES
Joergen Kjems Aug. 1970 56 p refs Supported by Rudolph Als Found.
(RISO-229) Avail: AEC Depository Libraries

A position sensitive thermal neutron He-3 detector system

with 7.8 mm resolution is described together with its application to two different spectrometers. One uses the time-of-flight technique, and the other uses a single crystal for the energy analysis of the scattered neutrons. The scattering is measured simultaneously in an angle range of 6 deg. The performance of the instrument is demonstrated by measurements of critical magnetic scattering from Tb. The crystal spectrometer uses a large, single crystal for measurements of incoherent inelastic scattering from p-C6H4Cl2, and of coherent scattering by phonons in Zn. The two instruments are compared. Author (NSA)

N71-27634 Virginia Polytechnic Inst., Blacksburg.
CAPTURE CROSS SECTIONS IN THE keV REGIONS
Wayne Wesley Campbell (Ph.D. Thesis) 1970 81 p
Avail: Univ. Microfilms Order No. 70-11504

Natural silver and the isotopes Ag-107, Ag-109, In-115, and I-127 were irradiated by the monoenergetic neutrons emitted at 90 deg to a proton beam striking a Li-7 target. These samples were then counted for their gamma and beta activity and their absolute cross sections relative to the cross section of I-127 at 24 keV were calculated over the energy range of from 3 to 155 keV. These measured cross section versus energy curves were used to determine the gamma-ray strength functions, the s-wave neutron strength functions, and the p-wave neutron strength functions. Because of data limitations it has been assumed that the gamma-ray strength function is the same for both s- and p-wave neutrons. The cross sections determined are in general good agreement with the values previously reported but differ somewhat in shape. This shape variance results in values for the average resonance parameters which are previously reported. Dissert. Abstr.

N71-27635# United Kingdom Atomic Energy Authority, Harwell (England).
SOME EFFICIENCY CALCULATIONS FOR LITHIUM-6 SUSPENDED TARGET SEMICONDUCTOR SANDWICH SPECTROMETERS
A. E. Lord, J. A. R. Cousins, M. G. Silk, and P. J. Clements Aug. 1970 14 p
(AERE-R-6318) Avail: AEC Depository Libraries; HMSO 2s 6d; BIS $.60

The geometric efficiency of lithium-6 semiconductor spectrometers of the suspended target type has been calculated for isotropic neutron fluxes. A wide range of diode separations has been studied. It is shown that the geometric efficiency is not well predicted by earlier loss angle calculations nor by extrapolations from the data available for surface target spectrometers. NSA

N71-27637 Carnegie-Mellon Univ., Pittsburgh, Pa.
A THEORETICAL STUDY OF THE WEAK NONLEPTONIC DECAY MODES OF THE K MESON
Barry Ralph Holstein (Ph.D. Thesis) 1970 220 p
Avail: Univ. Microfilms Order No. 70-12428

Techniques employing current algebra and partially conserved axial vector current are applied to nonleptonic decay processes. Both CP conserving and CP violating cases are considered. The phenomenology of the effective kaon mass matrix is discussed and a theoretical estimate of the parameters of this matrix is given. The decay mode kaon yields 2 pions is then discussed phenomenologically and a current algebra model is constructed to describe this process. The decay mode kaon yields 3 pions is discussed phenomenologically and a current algebra model is constructed to describe this process. The predicted amplitudes and slopes in the various kaon yields 3 pions decays are found to be in reasonable agreement with experiment for the CP conserving case. Predicted values for various CP violating parameters are given in terms of one of the two Glashow phase angles. Dissert. Abstr.

N71-27642 California Univ., Riverside.
THE DIRECT PRODUCTION OF ELECTRON PAIRS IN NUCLEAR EMULSION BY 13.75 BeV ELECTRONS
Arthur Simmons Cary (Ph.D. Thesis) 1969 84 p
Avail: Univ. Microfilms Order No. 70-11983

Nuclear emulsions were exposed, and 1085 trident-like events were observed on 45 m of electron track. A correction technique, depending on the numerical integration of the Bethe-Heitler equations for bremsstrahlung radiation and pair production, was carried out. The number of bremsstrahlung pairs that one would expect to find in a radiation length was determined. Another method depends on the fact that the creation of bremsstrahlung pairs varies quadratically with the distance, while the yield for tridents varies linearly with the distance. A direct measure of the trident mean free path can be obtained by plotting the differential probability of the total distribution of apparent tridents in distance and by extrapolating the best fitting straight line to zero distance. The correction for pseudo-tridents using a numerical integration technique leads to values of the mean free path for direct pairs which are smaller than that predicted by theory. The method of extrapolating the differential distribution leads to values of the mean free path that are in excellent agreement with theory. Dissert. Abstr.

N71-27654 Georgia Inst. of Tech., Atlanta.
SCATTERING OF He(+) IONS BY NOBLE GASES AT HIGH ENERGIES
George Ormsbee Taylor, Jr. (Ph.D. Thesis) 1970 178 p
Avail: Univ. Microfilms Order No. 70-11193

The scattering of He(+) projectiles by impact on the noble gases, He, Ne, and Ar, was investigated in the energy range 120 to 830 keV under single collision conditions. Specifically, the experiment measured as a function of angle in the range one to eight degrees the total differential scattering cross section as well as the differential scattering cross sections for scattering without change of charge, for scattering with charge transfer, and for scattering with electron stripping. Also, the fraction of particles in a particular charge state was measured as a function of energy at fixed scattering angle. Dissert. Abstr.

N71-27655# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
ELECTRIC DISCHARGE OF GAS BUBBLES IN LIQUIDS
A. F. Pisarev, G. I. Selivanov, M. P. Balandin, and L. K. Lytkin 1970 14 p refs In RUSSIAN
(JINR-P13-5277) Avail: AEC Depository Libraries

The values of the field intensities, capable of inducing the bubble discharge in liquids, are calculated using the criteria and experimental dependences of the electric gas discharge in small gaps. The bubble discharge in liquid bubble chambers filled with the monatomic liquids is found to appear at the constant field intensity of about 200 kV/cm, and for the case of molecular liquids at 500-600 kV/cm. In high frequency fields, the discharge takes place at 50 and 300 kV/cm, respectively. Author (NSA)

N71-27656 Rensselaer Polytechnic Inst., Troy, N.Y.
ENERGY AND ANGULAR DISTRIBUTIONS OF PHOTONEUTRONS FROM LITHIUM 6 AND LITHIUM 7
Stephen J. Mecca (Ph.D. Thesis) 1969 171 p
Avail: Univ. Microfilms Order No. 70-11327

Photoneutron spectra from lithium 6 and lithium 7 have been measured at several angles, ranging from 30 deg to 152 deg, and at several bremsstrahlung end point energies from 20 to 75 MeV. A method of obtaining the differential cross section to various states in the residual nuclei has been developed. The maximum possible use is made of the yield spectra, even in energy regions where neutrons can go to more than one final state. The Li-6 and Li-7 yield data were used with this method to obtain the differential cross section to various residual energy states or residual energy regions. The results indicate small cross sections, ranging from microbarns to tens of microbarns, having gentle tail-off features. Dissert. Abstr.

N71-27657# Joint Inst. for Nuclear Research, Dubna (USSR).
INVESTIGATION OF THE Li-8 RECOIL NUCLEI IN THE Be-9(p,2p)Li-8 REACTION AT THE PROTON ENERGIES OF 180 AND 660 MeV
E. L. Grigoriev, O. V. Lozhkin, Z. Maric, V. C. Suslenko, and V. I. Kochkin 1969 25 p refs In RUSSIAN; ENGLISH summary
(JINR-P1-4872) Avail: AEC Depository Libraries

The results of the experimental analysis of the reaction are presented. The Li-8 recoil nuclei were detected by means of photoemulsions. The data on their energy distributions at the angles 50, 90, and 120 deg (for incident protons of the kinetic energy T = 660 MeV) and angles 50 and 90 deg (T = 180 MeV), and their angular distributions are reported. Theoretical analysis based on the pole Feynman diagram is carried out. Qualitative agreement of the theoretical analysis with the given experimental data has been obtained. NSA

N71-27658# Institute of Nuclear Physics, Krakow (Poland).
PARITY NONCONSERVING EFFECTS IN NUCLEI Lu 175 AND Ta 181
J. Grabowski 1970 10 p refs
(IND-714) Avail: AEC Depository Libraries

The nuclear part R of the parity nonconserving circular polarization in 343-keV and 396-keV gamma transitions in Lu-175 and 482-keV gamma transition in Ta-181 have been calculated. The Saxon–Woods type single particle wave functions were used. Author (NSA)

N71-27659# Institute of Nuclear Physics, Krakow (Poland).
GEOMETRICAL EFFECTS IN SCATTERING OF IONS BY SURFACE OF SOLIDS
Waldemar Soszka 1970 120 p refs In POLISH
(INP-710) Avail: AEC Depository Libraries

The spatial and energy distributions of ions scattered on a target having an ordered structure were investigated. The single and multiple collision approximations are considered. The experiments showed the existence of some geometrical correlations in multiple scattering. These correlations lead to anisotropy of spatial distributions and fine structure of the energy spectra. The considerations take account of the modulation of the primary beam due to the channel capture effect. Author (NSA)

N71-27660# Michigan Univ., Ann Arbor. Dept. of Physics.
A PROPOSED TEST OF THE CONSERVATION OF CHARGE CONJUGATION IN POSITRONIUM DECAY
H. S. Mani and Arthur Rich Mar. 1971 24 p refs
(Grant AF-AFOSR-1288-67)
(AD-720854; AFOSR-TR-71-0736) Avail: NTIS CSCL 20/8

If the electromagnetic interactions conserve charge conjugation, C, then singlet positronium (Ps) can only decay into an even number of photons, while triplet Ps can only decay into an odd number. In this paper one considers a model Hamiltonian which violates C but conserves parity. Author (GRA)

N71-27661# Oklahoma Univ. Research Inst., Norman.
ELECTRONIC DISCHARGE BREAKDOWN WAVES ASSOCIATED WITH NUCLEAR EXPLOSIONS AND IONOSPHERIC DISTURBANCES Final Scientific Report
Richard G. Fowler Feb. 1971 12 p refs
(Grant AF-AFOSR-1326-67)
(AD-720862; OURI-1606-FR; AFOSR-TR-71-0624) Avail: NTIS CSCL 20/14

Proforce and antiforce initiating anaelectrodiabatic (AED) waves have been the area of concentration for this task. This effort has consisted of review of past observations, development of experimental equipment, development of diagnostic techniques, extension of the Shelton theory, analysis of Johnston Island test data and studies of the effect of magnetic fields on these waves. Author (GRA)

N71-27672 Syracuse Univ., N.Y.
TOPICS IN THE DYNAMICS OF STRONG INTERACTIONS
William Joel Meggs (Ph.D. Thesis) 1969 112 p
Avail: Univ. Microfilms Order No. 70-12795

Calculational techniques in strong interaction physics are explored and applied to specific physical situations. It is found that overlapping resonances in three particle final states can produce resonance like structure for a certain spin configuration if a mass selection is made on the final state. Reported enhancements at 1080 Mev, 1169 Mev anf 1433 Mev in the missing mass plots of pion pion pion, kaon pion pion, and kaon kaon pion final states, respectively may be understood by this mechanism. The Balachandran-Nuyts expansion of scattering amplitudes on the Mandelstam triangle is discussed for the case of equal masses. It is found that the eigenfunctions belong to a certain class of basis vectors of the (muon, muon) representations of the group SU(3). Possible applications of this method to the pion pion bootstrap muon bootstrap are indicated. Dissert. Abstr.

N71-27688# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
NEUTRON DOSIMETRY AND SPECTROMETRY BY THE MULTISPHERE METHOD: PRESENT STATE OF THE STUDIES AT THE SERVICE D'ETUDES DE SURETE RAGIOLOGIQUE [DOSIMETRIE ET SPECTROMETRIE DES NEUTRONS PAR LA TECHNIQUE MULTISPHERE. ETAT ACTUEL DES ETUDES DU S.E.S.R.]
Georges Benezech, Michel Bricka, and Mylene Dolias 1970 21 p refs In FRENCH Presented at Intern. Summer School on Radiation Protection, Caviat, Yugoslavia, 21–30 Sep. 1970
(CEA-CONF-1685; Conf-700939-1) Avail: AEC Depository Libraries

Moderator spheres for neutron flux measurements in two principal directions are discussed. Attempts were made to measure directly the kerma fluence and the equivalent doses (rem) by using one or two or three spheres. Neutron spectra compatible with data from a more complete assembly of spheres were studied. The kerma fluences were obtained from those spectra. The multisphere technique led to an accuracy of 10% for the flux and 20% for the doses, measured in rem, and is particularly suitable for measurements in fields rich in intermediate energy neutrons. Multisphere spectrometry is of insufficient resolution for precise spectral analysis, but has been used successfully for the determination of fluences and doses in the 100 to 200 keV energy range. A rough estimation of dose can be made with a portable monitor which comprises a 4.2 inch sphere and which was developed for the routine detection of neutron leaks. Lithium iodide scintillation detectors, boron trifluoride proportional detectors, and activation detectors were used. Author (NSA)

N71-27689# Commissariat a l'Energie Atomique, Limeil-Brevannes (France). Centre d'Etudes.
APPROXIMATIONS DEDUCED FROM THE MILNE EQUATION ASSOCIATED TO THAT OF SCHROEDINGER [ETUDE D'APPROXIMATIONS DEDUITES DE L'EQUATION DE MILNE ASSOCIEE A L'EQUATION DE SCHROEDINGER]
Luc Dagens Nov. 1970 30 p refs In FRENCH
(CEA-R-4007) Avail: AEC Depository Libraries

New approximations for energy levels and corresponding wave functions in one dimension are derived. They are generalizations of WKB formules and are valid about the turning points. The starting point is the Milne equation associated with the Schroedinger equation through the substitution Psi = y sin Y + gamma, dY/dx = 1/(y sq). An outline of a rigorous proof is given, based upon the comparison equation method used by Erdelyi in a similar problem and using a new variational identity. A new proof of the WKB level formula is given as an application. The Milne transformation

of these approximations is shown to give uniform asymptotic approximations to the true wave functions, within a certain domain. The approximate density (in the functional meaning) associated to the new energy level formulas is derived and shown to verify the virial relation. Author (NSA)

N71-27690# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).

HAMILTONIAN THAT IMPLIES THE EXCLUSION PRINCIPLE [UN HAMILTONIANO CHE IMPLICA IL PRINCIPIO DI ESCLUSIONE]

G. Sacerdoti 25 May 1970 10 p In ITALIAN *Its* Nota Interna No. 478

(LNF-70/22) Avail: AEC Depository Libraries

The explicit function H' sub 0 of a Hamiltonian is derived with the same eigenvalues of those of a normal Hamiltonian H of a system of interacting many bodies. For the bosons the valid Hamiltonian can be that of the photon. Valid statistical and intermediate particles for quasi-fermions are possible which in high energy states can behave as quasi-bosons. The theoretical consequences of this formulation of the many body problem was not studied either in the interpretation of experimental results or in the suggestions of mathematical methods to resolve possible problems caused by this formulation. Author (NSA)

N71-27691# Institute of Nuclear Physics, Krakow (Poland).

POLARIZATION OF PROTONS FROM C-12(d,p)C-13 REACTION AT Ed EQUALS 12.4 MeV

A. Budzanowski, L. Freindl, W. Karcz, B. Lazarska, and W. Zipper 1970 27 p refs

(INP-711) Avail: AEC Depository Libraries

The polarization of protons from the C-12(d,p)C-13 reaction at 12.4 MeV was measured for the ground state (in the angular range 20 deg to 136 deg lab) and the first excited state (in the angular range 20 deg to 90 deg lab) transitions. The results obtained are compared to the vector analyzing power data for the same reaction and at the same energy of the incident deuterons. An attempt to fit the polarization data with the DWBA theory is also presented. Author (NSA)

N71-27692# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

RADIOLOGICAL ACCIDENTS: RULES TO BE OBSERVED IN THE EVENT OF ACCIDENTAL EXTERNAL IRRADIATION OR ACCIDENTAL RADIOACTIVE CONTAMINATION [ACCIDENTS RADIOLOGIQUES: CONDUITE A TENIR EN CAS D'IRRADIATION EXTERNE ACCIDENTELLE OU DE CONTAMINATION RADIOACTIVE ACCIDENTELLE]

H. Jammet, R. Le Go, and J. Lafuma Sep. 1970 61 p In FRENCH

(CEA-N-1365) Avail: AEC Depository Libraries

Radiological accidents fall into two groups: accidental external irradiation for which accidental overexposure, categories of irradiation, dosimetric information, clinical and biological rules to be observed, and therapeutic decisions are defined; and accidental radioactive contamination for which relationships between the metabolism and the physico-chemical state of the various isotopes, therapeutic procedures to be followed, and technical data-sheets for the various radioelements C-14, Cs, I, Pu, Pa, Sr, U, rare earths, tritium, transplutonium elements, and fission product mixtures) are established. NSA

N71-27693 Cornell Univ., Ithaca, N.Y.

PHOTOELECTRIC PROCESSES AND A SEARCH FOR EXCITON MOBILITY IN PURE AND DOPED ALKALI HALIDES

Steven William Duckett (Ph.D. Thesis) 1969 142 p

Avail: Univ. Microfilms Order No. 70-11226

Two types of experiments were performed using diffusion of photon-created excitons. In the first, the detector was a thin film on the surface of the alkali halide in which the excitons were created with sufficient energy to excite and eject an external electron from the film. An upper limit of 0.001 could be put on the probability of an exciton diffusing to the surface and creating an external electron. The transfer probability is 0.1 to 0.5. Using values in this interval and equations derived from a random walk model of exciton motion, a value of the upper limit of the average number of hops N < 2 was obtained; if the transfer probability is an order of magnitude lower than estimated, N < or approximately = 2. The other type of experiment was done with iodine atoms substituted in KCl and KBr crystals. The quantum yield of the photocurrent excitation process was measured as a function of the iodine concentration. These data also gave N approximately = 2 as an upper limit of exciton motion. It is concluded that the experiments indicate a prompt relaxation of the exciton into some self-trapped state. It is shown that previous experiments are consistent with the relaxation model. Dissert. Abstr.

N71-27694# Puerto Rico Nuclear Center, Mayaguez.

[RESEARCH AND DEVELOPMENT PROGRESS IN NUCLEAR SCIENCE, NUCLEAR ENGINEERING, PHYSICAL SCIENCES, CLINICAL RADIOISOTOPE APPLICATIONS, RADIOTHERAPY AND CANCER, TROPICAL AGRO-SCIENCES, MEDICAL SCIENCES AND RADIOBIOLOGY, REACTORS, HEALTH PHYSICS, AND RADIOECOLOGY] Annual Report, 1969

1969 157 p refs

(Contract AT(40-1)-1833)

(PRNC-140) Avail: NTIS

Research and development progress in nuclear science, nuclear engineering, physical sciences, clinical radioisotope applications, radiotherapy and cancer, tropical agro-sciences, medical sciences and radiobiology, reactors, health physics, and radioecology is outlined. The international exhibits program is described, and papers, publications, and seminars are listed. NSA

N71-27701 Wisconsin Univ., Madison

STRANGE PARTICLE PRODUCTION IN ANTIPROTON DEUTERON ANNIHILATIONS IN FLIGHT

Narender Kumar Sehgal (Ph.D. Thesis) 1970 210 p

Avail: Univ. Microfilms Order No. 70-8331

Results from a study of antiproton deuteron annihilations at four incident antiproton momenta between 1.25 and 1.67 GeV/c are presented. A total of 159,000 pictures taken in the deuterium-filled 30-inch MURA chamber was used. Only events with at least one visible charged decay of neutral kaon, Lambda hyperon, or anti-Lambda hyperon were considered. Cross sections were measured for antiproton neutron, antiproton proton, and antiproton deuteron processes. The impulse approximation was used wherever the number of kinematic constraints necessitated it. The spectator momenta agreed well with the appropriately normalized and modified Huthen distributions. In both of the first two reactions $K^*(890)$ was found to be abundantly produced, and there is clear evidence for the production of other well established resonant states. One significant result is the fairly consistent domination of the ispin zero over the ispin one amplitude in the first two reactions. The cross section for Lambda hyperon production in the third reaction seems to vary little in the available range of antiproton deuteron center of mass energy. Data are interpreted to rule out certain mechanisms for Lambda hyperon production in antiproton deuteron annihilations. Dissert. Abstr.

N71-27705# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).

GAMMA RADIATION FOLLOWING THE CAPTURE OF NEUTRONS, ESPECIALLY OF POLARIZED REACTOR NEUTRONS BY ORIENTED NUCLEI [UEBER DIE GAMMASTRAHLUNG NACH DEM EINFANG VON

NEUTRONEN, INSBESONDERE POLARISIERTEN REAKTORNEUTRONEN DURCH ORIENTIERTE ATOMKERNE]
Klaus Weise (Ph.D. Thesis) Jun. 1970 120 p refs In GERMAN
(FMRB-33/70) Avail: AEC Depository Libraries

The ratio sigma(alpha) sub 1 + 1 + 1/2/Sigma(alpha) sub 1 − 1/2 of the cross sections of the (n,gamma) process at low neutron energies outside the resonances, and for the different total angular ommenta J = I + or − 1/2 of the neutron−target-nucleus system for nuclei with ground state spin I > 0, is simply derived from the integral F(U)X(U)dU, which is determined by means of polarized neutrons and oriented nuclei in a thin target for two different degrees of neutron polarization. Z(U) is a linear combination of the gamma radiation pulse-height spectra measured at two definite angles to the direction of the nuclear orientation. F(U) is arbitrary if the function Z(U) varies only slightly (except for normalization) when neutron polarization is altered. With several neutron-capture mechanisms (direct, compound, valence-nucleon, and doorway capture, and one- and more-particle deexcitation processes) included, the gamma spectrum is calculated from the solution of a system of integral equations given by the cascade theory. The characteristic properties of the spectrum and its dependence on the various parameters are discussed. The 5-MeV anomaly seems to arise from the valence-nucleon capture mechanism. Author (NSA)

N71-27706# Institute of Nuclear Research, Warsaw (Poland).
MEASUREMENT OF HIGH ENERGY gamma RAY SPECTRA IN A STRONG NEUTRON FLUX
J. S. Brzosko, E. Gierlik, A. Sottan, Jr., and Z. Wilhelmi 1970 12 p refs
(INR-1224) Avail: AEC Depository Libraries

A method for measuring high-energy gamma rays in a strong neutron flux is elaborated. Advantages of this method are high efficiency of the detection of the gamma rays from (n, gamma) reactions and maximum reduction of the gamma ray background caused by interactions of the neutrons with the surroundings (especially important in a small target room). Author (NSA)

N71-27736*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECTS OF CHARGED PARTICLE AND UV RADIATION ON THE STABILITY OF SILVERED AND ALUMINIZED FEP TEFLON SECOND SURFACE MIRRORS
Walter A. Wappaus May 1971 25 p refs Prepared in part by Electromech. Res., Inc., College Park, Md.
(Contract NAS5-11326)
(NASA-TM-X-65559; X-762-71-192) Avail: NTIS CSCL 20H

A series of tests were conducted on metallized 5 mil FEP teflon film second-surface mirror thermal control coatings to determine the solar absorptance stability as a function of electron, proton and UV radiation dosage. Both silvered and aluminized FEP teflon coatings were irradiated with particle energies of 5 Kev and 25 Kev and with UV at an intensity of 5 solar constants. The combined effect of simultaneously irradiating these coatings with both UV and charged particle radiation was also investigated. Results show that both silvered and aluminized coatings are more unstable to 25 Kev protons than to 25 Kev electrons. The combined effect of UV plus charged particle radiation produces greater instability at higher dose levels than the effect of charged particle radiation alone. The stability of the FEP teflon coatings are virtually unaffected by UV exposure in vacuum at 5 solar constants for 120 hours. The coatings are also stable to 5 Kev electrons. Author

N71-27744# Oak Ridge National Lab., Tenn.
HEALTH PHYSICS DIVISION Annual Progress Report, Period Ending 31 Jul. 1970
Oct. 1970 255 p refs
(Contract W-7405-eng-26)
(ORNL-4584) Avail: NTIS

Studies on radioactive waste disposal, radiation physics, radiation dosimetry, and internal dosimetry are reported. The waste disposal investigations cover history of trace elements and radionuclides in terrestrial environment; disposal by hydraulic fracturing; facility design for disposal in natural salt formations; engineering, economic, and safety evaluation; routine operation of the seismograph station; does estimations related to peaceful uses of nuclear explosives; and cooperative projects. Theoretical radiation physics, radiation interactions with liquids and solids, tissue damage, electron and ion collision, and atomic and molecular radiation are discussed. Dosimetry research investigations are described on human exposures and radiobiology, spectrometry, applied research, reactor and accelerator operations, internal dose estimation, and stable element metabolism. N.E.N.

N71-27745 Johns Hopkins Univ., Baltimore, Md.
THE KAON(+) PION(−) SCATTERING AND RELATED EFFECTS IN THE REACTION KAON(+) PROTON YIELDS KAON(+) PION(−) DELTA HYPERON (2+) AT 5.43 BeV/c
Robert Allen Mercer (Ph.D. Thesis) 1969 152 p
Avail: Univ. Microfilms Order No. 70-11791

Kaon(+) proton interactions occurring in the eighty-inch bubble chamber at an incident kaon(+) momentum of 5.43 GeV/c are analyzed. This exposure corresponds to .187 microbarn/event cross section, and there are 10,200 unambiguous fits to the reaction kaon(+) proton yields kaon(+) pion(−) pion(+) proton. The kaon(+) pion(−) Delta hyperon(2+) substate of this final state was examined in terms of the one-pion exchange model, allowing a study of kaon(+) pion(−) virtual scattering. By extrapolating from the physical region to the point where the exchanged pion becomes real, the real kaon pion scattering was also studied. The resulting elastic scattering cross section agrees with the P-wave unitarity limit at 890 MeV. A broad, low mass enchancement, the N', appears in the Delta hyperon(2+) pion(−) mass spectrum of the kaon(+) pion(−) Delta hyperon(2+) final state, similar to that observed in many pion proton and proton proton interactions. It is shown to be primarily or entirely a nonresonant effect; and, in fact, appears to be a manifestation of processes similar to one pion exchange. The Ross-Yam model applied to the effect predicts mass and decay angular distributions qualitatively similar to the observed distributions. Dissert. Abstr.

N71-27749# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
METHODS OF QUANTITATIVE ANALYSIS OF A GAMMA SPECTRUM [METODI DI ANALISI QUANTITATIVA DI UNO SPETTRO GAMMA]
L. Frittelli 14 Jul. 1970 47 p refs In ITALIAN
(RT/PROT-(70)21) Avail: AEC Depository Libraries

Numerical methods of quantitative analysis of digital gamma spectra are described and compared. Author (NSA)

N71-27751# Democritus Nuclear Research Center, Athens (Greece).
REMARKS ON PION(+)-PHOTOPRODUCTION WITH LINEARLY POLARIZED PHOTONS
G. M. Papaioannou and A. Vergenelakis [1969] 12 p refs
(DEMO-70/1) Avail: AEC Depository Libraries

It is shown that the statement that polarized photons parallel to the production plane, to leading order in s, select out only unnatural parity contributions in pion(+) photoproduction, is not correct. It is found that natural spin parity contributions also enter to d sigma/dt for parallel gammas parallel to the production plane. Author (NSA)

N71-27762# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
TWO-QUASI-PARTICLE (h9/2)2 ISOMERIC STATE IN Po 202
U. Hagemann, W. Neubert, and W. Schulze 1970 11 p refs Submitted for publication
(JINR-E6-5379) Avail: AEC Depository Libraries

In Po-202 a two quasi-particle state of the configuration (h sub 9/2)2 with half-life T sub 1/2 = 165 + or − 20 ns and transition energies 443, 571, and 677 keV was found. In Po-204 the half life of the I sup pi = 8(+) isomeric state was measured as T sub 1/2 = 140 + or − 5 ns. Author (NSA)

N71-27762# Interuniversitair Reactor Instituut, Delft (Netherlands).
SLOW ELECTRONS AND NEGATIVE IONS IN ORGANIC LIQUIDS
A. Hummel 1969 19 p refs Presented at 4th Intern. Congr. of Radiation Res., Evian, France, 28 Jun.—4 Jul. 1970
(IRI-133-70-2; CONF-700610-10) Avail: AEC Depository Libraries

A simplified model of the behavior of charged entities in the track of a fast electron slowing down in a liquid, based on a predominant contribution of pairs of charged species than can be treated with classical diffusion theory, is discussed. Comparison of the theory with result from measurements of the electric conductance of liquids under irradiation and from the observation of ions formed during a short burst of irradiation yields information about the spatial distribution and the behavior of the charged species in the track of a fast electron. Author (NSA)

N71-27765# Kernforschungszentrum, Karlsruhe (West Germany) Inst. fuer Angewandte Kernphysik.
A COMPUTER PROGRAM FOR DISCOVERY OF EXCITED NUCLEAR STATES ACCORDING TO THE RITZ COMBINATION PRINCIPLE [EIN COMPUTER PROGRAMM ZUM AUFFINDEN VON ANGEREGTEN KERNZUSTAENDEN NACH DEM RITZSCHEN KOMBINATIONSPRINZIP]
Dieter Heck Jul. 1970 35 p refs In GERMAN; ENGLISH summary
(KFK-1247) Avail: AEC Depository Libraries

With a set of measured gamma ray energies and a few known level energies as a starting point, the Ritz combination principle may be used to construct a more nearly complete level scheme. This problem is well suited for application of a computer, since certain operations such as forming a sum or a difference of two gamma-ray energies, or forming a difference of two level energies, and comparing these two quantities, must be performed many thousands of times in most cases. The program developed, which is especially adapted to the data obtained from the (neutron,gamma) reaction, is listed herein. Author (NSA)

N71-27768# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
CALCULATION OF THE ION TRAJECTORIES IN FRONT OF A FIELD EMISSION TIP [BERECHNUNG DER IONENBAHNEN VOR EINER FELDEMISSIONS-SPITZE]
H. Vernickel and H. Welter Jun. 1970 26 p refs In GERMAN; ENGLISH summary Presented at 16th Field Emission, Symp., Pittsburgh, Sep. 1969
(IPP-7/12; Conf-690968-1; IPP-6/88) Avail: AEC Depository Libraries

The equations of motion of the ions produced by ionization of the gas between tip and screen of a field-emission microscope have been numerically integrated for two tip geometries (drop-like and rounded-off cone). Based on these results, the ion-current density and the energy distribution of the ions impinging on the tip were calculated. The results indicate that all ions hitting the imaged part of the tip originate within a small pencil around the emitter axis; the maximum of the energy distribution is, depending on tip geometry, between 0.03 and 0.2 of the energy corresponding to the voltage between anode and tip. Author (NSA)

N71-27767 California Inst. of Tech., Pasadena.
HIGH ENERGY PHOTOPRODUCTION OF NEUTRAL MESONS
David Louis Kreinick (Ph.D. Thesis) 1970 167 p
Avail: Univ. Microfilms Order No. 70-12439

Cross sections for the photoproduction of neutral pi, eta, rho and phi mesons on hydrogen have been measured using a missing mass spectrometer technique. Production of particles with masses between 1100 and 2000 MeV was sought. A broad resonance with mass 1240 + or + 20 MeV was observed. It is tentatively identified with the B meson No particle of mass between 1300 and 2000 MeV and width less than 200 MeV was produced with a cross section larger than about 10 percent of the rho's. Dissert. Abstr.

N71-27768 Brown Univ., Providence, R.I.
NUCLEAR MAGNETIC RESONANCE STUDIES OF THALLIUM BORATE GLASSES AND POLYCRYSTALLINE METAVANADATE COMPOUNDS
Joseph Fontaine Baugher (Ph.D. Thesis) 1969 237 p
Avail: Univ. Microfilms Order No. 70-8689

A study of nuclear magnetic resonance (NMR) powder patterns is presented, and a technique is described for the determination of the locations of the shoulders and singularities in the powder patterns for arbitrary nuclear spin Hamiltonians. Specific examples of NMR powder patterns are discussed for the electric quadrupole interaction, the anisotropic chemical shift interaction, and combined anisotropic chemical shift and electric quadrupole interactions. The effects of the nuclear dipole-dipole interaction on NMR powder patterns are studied by the use of computer techniques. The effects of dipole-dipole interactions are simulated by numerically convoluting the calculated powder pattern with either Gaussian or Lorentzian convolution functions of varying widths. A technique is described for the measurement of quadrupolar and anisotropic chemical shift effects by the comparison of experimental spectra with computer evaluated traces. Dissert. Abstr.

N71-27769# Gosudarstvennyi Komitet Po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
CALCULATION OF BOX DIAGRAM EFFECTS WITH TWO RESONANCES IN THE INTERMEDIATE STATE
V. V. Anisovich and M. N. Kobrinskii 1970 28 p refs In RUSSIAN
(IFVE-STF-70-34) Avail: AEC Depository Libraries

The box diagrams with resonances in the intermediate state have singularities, that can lie close to the physical region. The calculation of the singularities of these diagrams is presented in the explicit form for the cases of scalar and vector resonances. The detailed investigation of the conditions, under which the box diagram singularities are close to the physical region, is presented. The effects that appear in given processes were calculated. Author (NSA)

N71-27780 Cornell Univ., Ithaca, N.Y.
WIDE ANGLE BREMSSTRAHLUNG: ANGULAR DEPENDENCE
Carl Arthur Lichtenstein (Ph.D. Thesis) 1970 148 p
Avail: Univ. Microfilms Order No. 70-12632

The cross section for Wide Angel Bremsstrahlung was measured by electron-photon coincidences, using the circulating beam of the Cornell 10 GeV electron synchrotron. Earlier work with the electron spectrometer and photon detector placed symmetrically about the incident beam was extended by placing the detectors in two asymmetric arrangements, thus varying the ratio of timelike to spacelike masses contributing. Data were taken

around the point of transverse momentum balance (minimum momentum transfer to the nucleus) at several energies in each arrangement. In the large photon angle arrangement, a background of electroproduced pions prevented an accurate measurement. For the large electron angle case, the data confirm the predictions of Quantum Electrodynamics. Dissert. Abstr.

N71-27781 California Univ., San Diego.
A TEST OF THE DELTA S EQUALS DELTA Q RULE IN NEUTRAL K-e3 DECAY
Laurence Stephen Littenberg (Ph.D. Thesis) 1969 181 p
Avail: Univ. Microfilms Order No. 70-13225

Neutral K-e3 decay in the neutral kaon-neutral antikaon interference region were studied. The neutral kaons were produced by the charge exchange of a 1 BeV/c separated positive kaon beam. The three charge exchange targets were separated by spark chambers to allow determination of the charge exchange point. The kaons decayed in a thin foil spark chamber situated in a magnetic field. Electrons were identified by their showers in a 12 gap spark chamber with 1/8 inch lead plates between the gaps. The visual and kinematical filtering procedure reduced the competing decay modes (primarily kaon sub S yields positive pion negative pion) from 400:1 to <0.10:1 in the most sensitive region (tau <3 tau sub S). The lifetime distributions of selected positron negative pion antineutrino and electron positive pion neutrino events were fit to theoretical distributions using a Monte Carlo-calculated detection efficiency curve. Dissert. Abstr.

N71-27789# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
COMPARATIVE PERFORMANCES OF MONTE CARLO AND DISCRETE ORDINATE ON DIMENSIONAL TRANSPORT CODES IN AN IRON BULK SHIELD CALCULATION
Christian Devillers 1970 17 p refs Presented at the Monte Carlo Seminar Workshop, Oak Ridge, Tenn., 5–7 Oct. 1970
(CEA-CONF-1669; CONF-701020-1) Avail: AEC Depository Libraries

A comparative study was made on the propagation of neutrons through a large thickness of iron for two one-dimensional transport codes, NIOBE anf ANISN and the one-dimensional POKER code. The comparison between the results obtained from the NIOBE and POKER codes indicated the influence of different data treatments using the same library (UNC). NIOBE uses a pseudo-multigroup calculation and POKER a linear interpolation. The comparison of the results obtained using the POKER and the ANISN codes contrasts the use of the ENDF/B library in place of the UNC library. The comparison between the measured and the calculated responses demonstrates the possible inadequacy of the cross sections used. The experimental results were obtained from the iron column of the Harmonie reactor using sulfur-, rhodium-, and manganese-activated detectors. NSA

N71-27790 Texas Technological Univ., Lubbock.
TWO-ELECTRON CORRELATION EFFECTS IN HARTREE-FOCK ATOMIC SYSTEMS
James Marshall Minor (Ph.D. Thesis) 1969 194 p
Avail: Univ. Microfilms Order No. 70-12322

To improve the multiplet structure for two open-shell electrons outside a closed-shell core, a Hylleraas-type correlation function is applied to a Clebsch-Gordan combination of Hartree-Fock orbitals for the two electrons. The Hartree-Fock solutions are in the form of short analytical expansions, as provided by Roothaan's method of calculating Hartree-Fock wave functions. Correlations between the open-shell electrons and the closed-shell electrons is neglected, as well as open-shell-correlation effects upon the inert core. The (2p) squared configuration for carbon through argon is treated with great success for the lighter elements, although for the heavier ions, the agreement with experimental results diverges. Suggestions for improvement of this behavior center around the inclusion of effects resulting from the 2s-2p near-degeneracy. Dissert. Abstr.

N71-27795# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
MASS COEFFICIENT IN THE NUCLEUS COLLECTIVE HAMILTONIAN AND SUM RULES FOR THE PROBABILITIES OF E2 TRANSITIONS AND OF QUADRUPOLE MOMENTS
R. V. Dzholos 1970 18 p refs In RUSSIAN
(JINR-P4-5346) Avail: AEC Depository Libraries

In the framework of the collective model for certain assumptions on the kinetic energy structure, different relations were obtained for the matrix elements of the quadrupole moment operator and the collective state energies. The dependence of the mass coefficient in the collective Hamiltonian on the deformation parameters is investigated. Author (NSA)

N71-27796# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
SEPARATION METHODS OF NOBLE FISSION EASES FROM GASEOUS EFFLUENTS
Antonio Cardinale Aug. 1970 64 p refs
(CEA-Bib-184) Avail: AEC Depository Libraries

The physical principles of the various methods used for the separation of noble fission gases from gaseous effluents are reviewed. Diffusion through permselective membranes, thermal diffusion, absorption and fractional extraction into solvents, clathrate formation, low temperature distillation, and adsorption in solids are described. A description is also given of the main applications made up in the nuclear industry. Price estimates are presented for installations based on these principles and the advantages and disadvantages of each installation are listed. Author (NSA)

N71-27797# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON THE DECAYS PION(+) YIELDS POSITRON (MUON(+)) NEUTRINO POSITRON ELECTRON
D. Yu. Bardin, S. M. Bilenkii, G. V. Mitselmakher, and N. M. Shumeiko 1970 28 p refs In RUSSIAN
(JINR-P2-5520) Avail: AEC Depository Libraries

The integral probability of the process positive pion yields 1(+) neutrino sub 1 positron electron is calculated. It is shown that studying the decay positive pion yields positron neutrino sub e positron electron at different detection thresholds of final charged particles gives information on the gamma parameter (the ratio of the axial form factor to the vector in the decay positive pion yields positron neutrino sub e gamma), on the electromagnetic radius of pi-meson, and on the sign of neutral pion yields 2 gamma amplitude to be obtained. Author (NSA)

N71-27798# State Committee for the Utilization of Atomic Energy, Moscow (USSR).
MANY-BARYON RESONANCES
L. A. Kondratyuk and I. S. Shapiro 1970 32 p refs
(ITEF-759) Avail: AEC Depository Libraries

The quasi-nuclear model of many baryon resonance, which results from delta N potential interaction, is formulated. The interaction delta-N, decay modes and production mechanisms of two- and three-baryon resonances, involving delta isobar, are investigated. The experimental data on two-baryon resonances with isospin T = 1 are analyzed. Author (NSA)

N71-27799# Institute of Nuclear Research, Warsaw (Poland)
CLASSICAL THEORY OF ATOMIC COLLISIONS. 2: ELASTIC ATOMIC COLLISIONS [KLASYCZNA TEORIA ZDERZEN ATOMOWYCH. 2: TEORIA ELASTYCZNYCH ZDERZEN ATOMOWYCH]

M. Gryzinski 1970 118 p refs In POLISH; ENGLISH summary
(INR-P-1225) Avail: AEC Depository Libraries

A method for description of elastic atomic collisions based on the concepts of classical physics is given. General considerations are presented on scattering resulting from the existence in interacting objects of multipole moments of different order, both constant and varying in time. It has been shown that the exponential decrease of interaction effectiveness is the characteristic feature of dynamic systems. It is shown that the Ramsauer effect is connected with the dynamic nature of the atomic shell, while the intermolecular forces (van der Waals forces) are determined primarily by the time-averaged multipole moments characteristic of an external atomic shell. On the basis of experimental material concerning elastic scattering, the basic multipole moments of some atoms and molecules are determined. The values of these moments are estimated, and the basic shell frequencies are calculated. It is found that there exists agreement between the results obtained and the concept of atomic structure given by the author previously (according to which electrons in an atom move synchronously over radial trajectories of free fall at definite symmetry and space orientation). It is also illustrated by a number of relevant examples that the classical theory of scattering when combined with the classical theory of the atom enables a quantitative analysis of a wide variety of physical phenomena. Author (NSA)

N71-27800# Mainz Univ., (West Germany). Inst. fuer Anorganische Chemi und Kernchemie.
[NUCLEAR AND REACTOR CHEMISTRY RESEARCH] Annual Report, 1969
Oct. 1970 141 p refs In GERMAN; ENGLISH summary
(BMBW-FBK-70-19) Avail: AEC Depository Libraries

The report is composed of the following parts: performance of the TRIGA reactor (Mainz); rapid chemical separations and identification of short-lived nuclides; nuclear spectroscopy; mass- and charge-distribution in fission and cross sections; search for superheavy elements; activation analysis; and fallout studies. Author (NSA)

N71-27803# Institute of Nuclear Research, Warsaw.
EXCITATION OF ISOMERIC ACTIVITIES IN Ge-71, Br-78 AND Br-79 USING 14.8 MeV NEUTRONS
E. Rurarz, Z. Haratym, T. Kozlowski, and J. Wojtkowska 1969 26 p refs Submitted for publication
(INR-P-1091) Avail: AEC Depository Libraries

The cross sections for the production of the isomeric states in Ge-71, Gr-78, and Br-79 were measured using 14.8-MeV neutrons. The half-lives and energies of these isomeric activities were remeasured for checking the assignments. Data were obtained for the following: Ge-71(n,2n)Ge-71 sub m, Br-79(n,2n)Br-78 sub m, and Br-79(n,n') × Br-79 sub m. Author (NSA)

N71-27808# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
RELATIVE VALUE OF THE CROSS SECTIONS OF NUCLEON NUCLEON YIELDS W + (HADRONS) AND NUCLEON NUCLEON YIELDS (HADRONS) gamma, gamma YIELDS MUON + MUON REACTIONS
V. N. Folomeshkin 1969 13 p refs In RUSSIAN; ENGLISH summary
(IFVE-SEF-69-81) Avail: AEC Depository Libraries

The muon background of electromagnetic origin in the experiments on the search for W-boson in NN-collisions is estimated. Author (NSA)

N71-27812# Central Research Inst. for Physics, Budapest (Hungary).
TWO DIMENSIONAL (T1/2, EGAMMA) MAPPING OF SHORT LIVED NUCLIDES
A. Z. Nagy, A. Csoke, and E. Szabo 1970 23 p refs
(KFKI-70-18-NAC) Avail: AEC Depository Libraries

A map of 117 reported gamma emitters with half-lives less than 1 minute and gamma energies from 0.01 to 10 MeV produced by (n,alpha), (n,p), (n,2n), (n,gamma), or (n,n'gamma) reactions with fast or thermal neutrons is presented. Various reactions, including cross sections and threshold energies, which can be used to produce these nuclides are tabulated. The publication can be used to select activities for activation analysis with different types of neutron sources. NSA

N71-27814# Institute of Nuclear Research, Warsaw (Poland).
BETA SPECTROMETER WITH A Si(Li) DETECTOR IN HOMOGENEOUS MAGNETIC FIELD
A. Plochocki, E. Belcarz, M. Slapa, M. Szymczak, and J. Zylicz 1970 10 p refs Submitted for publication
(INR-P-1227) Avail: AEC Depository Libraries

A beta spectrometer is described which uses a Si(Li) detector together with a system of diaphragms in a homogeneous magnetic field. Lead shielding between the source and detector provides a partial protection of the detector against electromagnetic radiation from the source and the diaphragms make it possible to select a desired energy range of electrons for investigations. The instrument seems to be especially useful when studying very low intensity effects in the presence of intense electron radiation of another energy. Author (NSA)

N71-27815# Jyvaskyla Univ. (Finland). Dept. of Physics.
LEVEL STRUCTURE OF Sn 120 FROM THE DECAY OF In 120 AND Sb 120 ISOMERS
E. Liukkonen and J. Hattula Oct. 1970 31 p refs
(NP-18598) Avail: AEC Depository Libraries

Gamma rays in the decay of the 3.2 sec (1+) and 44 sec (4.5+) In-120 isomers and the 15.9 min (1+) and (8−) Sb-120 isomers have been investigated using Ge(Li) spectrometers and prompt and delayed Ge(Li)−NaI(Tl) coincidence techniques. The constructed level scheme of Sn-120 contains 18 levels at the following energies (keV): 0(0+), 1171.6(2+), 1875.6(0+), 2096.9 (1,2,3), 2160.7(0+), 2195.0(4+), 2284.8(5−), 2355.6(2+), 2421.2 (1,2,3), 2466.3(4+), 2482.1(7−), 2643.4(4+), 3058.6(4+), 3179.7(4+), 3349.9(3,4+), 3440 (3,4+), 3447.6 (5,6+) and 3777 (4+). The levels are compared with the levels obtained from recent charged-particle reaction studies and the structure of Sn-120 is briefly discussed in view of the latest quasiparticle calculations. Author (NSA)

N71-27816# Institut Rudjer Boskovic, Zagreb (Yugoslavia).
INELASTIC PROCESSES AND BACKWARD SCATTERING IN A MODEL OF MULTIPLE SCATTERING
I. Dadic, M. Martinis, and K. Pisk [1970] 37 p refs
(IRB-TP-2-70) Avail: AEC Depository Libraries

The relativistic model of multiple scattering is discussed on the basis of similarity which may be established between the model and the nonrelativistic potential scattering. The problem of nonrelativistic high energy forward and backward scattering as obtained from the Klein-Gordon type equation as well as the many channel situation and the treatment of exchange forces are considered in detail. Eikonal type approximations for forward and backward scattering are obtained. Restrictions due to unitarity on the high energy behavior of the derived scattering amplitude are discussed in terms of a unitarity bound. A generalization of the procedure to an aribtrary inelastic process is given. Some interesting relations between forward and backward amplitudes at high energies are obtained. It is also shown that the model contains the absorption model as a special case, and corrections due to backward scattering and to the random phase assumption are obtained. Author (NSA)

N71-27817 Johns Hopkins Univ., Baltimore, Md.
STUDIES OF THE FIRST 2(+) STATES OF Sm-154 AND

U-238 USING THE MOESSBAUER EFFECT FOLLOWING COULOMB EXCITATION
Richard Merrill Wheeler (Ph.D. Thesis) 1969 152 p
Avail: Univ. Microfilms Order No. 70-11806

The magnetic dipole and electric quadrupole hyperfine interactions of Sm-154 have been measured in SmCl2-6H2O at 30 deg and 4.2 K and in SmIG at 4.2 K. With a value for the internal magnetic field acting on the Sm nucleus in SmCl2-6H2O, and a free ion value for the electric field gradient in Sm, the results in SmCl2-6H2O have been used to determine the magnetic dipole and electric quadrupole moments. The isomer shift of the 82 keV transition in Sm-154 between Sm2O3 and Sm86 has been measured. U-238 has been studied in the compounds alpha uranium metal, U3O8, (UO2)(NO3)2-6H2O and UO2 above 30 deg and UO2 at 4.2 K. The Mossbauer absorption spectra of U3O8 and (UO2)(NO3)2-6H2O have been interpreted in terms of pure quadrupole interactions ME measurements of UO2 at 77 deg and 4.2 K were interpreted in terms of a pure magnetic hyperfine interaction. A new ME-CE technique featuring independent target and absorber cryogenic supplies is reported. Dissert. Abstr.

N71-27818# Grenoble Univ. (France). Faculte des Sciences.
ABSOLUTE MEASUREMENTS IN FAST NEUTRON REACTIONS: THE n + D YIELDS nnp REACTION AT 14 MeV [CONTRIBUTION A LA DETERMINATION DE MESURES ABSOLUES POUR LES REACTIONS AVEC NEUTRONS RAPIDES: APPLICATION A LA REACTION n PLUS D YIELDS nnp A 14 MeV]
Abdelmajid Kossentini (Ph.D. Thesis) 8 May 1970 70 p refs In FRENCH
(NP-18488) Avail: AEC Depositor Libraries

The problem of the absolute measurement of the cross sections for fast neutron reactions with energies between 1 and 15 MeV was studied. The application envisaged was the study of a three-nucleon system by the reaction n + D yields nnp at 14.5 MeV at different points on the Dalitz plot. The spectra of the neutrons and the absolute value of their energy for the t(d,n)He-4 reaction used, were measured by the time-of-flight techniques; the precision with which the energy was measured was better than 1% and the overall resolution of approximately 1 nsec corresponded to an energy dispersion of approximately 260 keV. Using three series of measurements the efficiency of the neutron detector was determined with equally good precision (2 to 5%): the relative measurement by the usual method of (n-H) scattering from approximately 2 to 15 MeV, the absolute measurement at 14.5 MeV using the T(d,n)He-4 reaction, and the absolute measurement at 2.5 MeV using the D(d,n)He-3 reaction. A value of the differential cross section for the reaction D(n,nnp) with geometries corresponding to the singularities nn or np was determined. NSA

N71-27819# Junta de Energia Nuclear, Sacavem (Portugal). Lab de Fisica e Engenharia Nucleares.
BEHAVIOR OF NEUTRONS IN A MULTIPLYING MEDIUM: DEFINITION OF KINETIC PARAMETERS
Jaime M. Costa Oliveira 1969 22 p refs In PORTUGUESE
(LFEN-NI-46-a) Avail: AEC Depository Libraries

The behavior of neutrons in a multiplying medium is theoretically considered and the definitions of kinetic parameters are derived. The Boltzmann equation is applied to the evolution, production, and loss of neutrons in a multiplying medium. The effect of the introduction of neutrons to a multiplying medium is derived. The kinetic equations are given, and approximations are made of the kinetic equations. The prompt kinetic equations are derived. NSA

N71-27820# Atomic Energy Establishment, Winfrith (England).
PROTON RECOIL COUNTER TECHNIQUES IN ZEBRA
A. M. Broomfield and M. D. Carter Dec. 1969 24 p refs
(AEEW-M-905) Avail: AEC Depository Libraries; HMSO 4s 6d; BIS$1.00

Spherical hydrogen-filled proton recoil proportional counters are used for measurements of neutron spectra between 5 keV and 1 MeV in fast reactor assemblies built in ZEBRA. The technique used for these measurements and their analysis is described. Author (NSA)

N71-27822# Michigan State Univ., East Lansing. Dept. of Chemistry.
ESR STUDY OF THE 102F(−) RADICAL IN GAMMA-IRRADIATED SINGLE CRYSTALS OF POTASSIUM OXYFLUOROIODATE
S. Subramanian and Max T. Roger 1970 23 p refs Sponsored by AEC
(COO-1385-34) Avail: NTIS

Single crystals of KIO2F2 gamma irradiated at room temperature, or irratiated at 77 K and allowed to warm above 140 K, gave ESR spectra characteristics of the 27-electron radical anion IO2F-. The unpaired electron is predominantly delocalized over the iodine and oxygen atoms and interacts only weakly with the fluorine atom. Loss of a fluorine atom from IO2F2- would lead to a radical structure based on a trigonal bipyramid with the electron pair and two oxygen atoms in equatorial positions and the fluorine atom and odd electron in apical positions. The ESR data are consistent with an arrangement of this type and with some involvement of iodine 5d orbitals in the bonding. Author (NSA)

N71-27827 Wisconsin Univ., Madison.
A STUDY OF THE VECTOR ANALYZING POWER IN DEUTERON STRIPPING REACTIONS ON O-16, Cr-52, Fe-54, Zr-90
Paul James Bjorkholm (Ph.D. Thesis) 1970 152 p
Avail: Univ. Microfilms Order No. 70-8268

Polarized deuterons were used to study deuteron stripping reactions and deuteron elastic scattering on targets of O-16, Cr-52, Fe-54, and Zr-90 at laboratory angles between 15 deg and 150 deg for deuteron energies between 8 and 12 MeV. The azimuthal asymmetry of the outgoing particles was measured to determine the vector analyzing power of the reactions and scattering. The elastic scattering cross-sections and vector analyzing powers were analyzed to obtain deuteron optical model potentials. These potentials were used for distorted wave Born approximation calculations of the cross-section, vector analyzing power, and proton polarization of the (d,p) reactions. A comparison of the calculations and data was used to determine the total angular momentum (j) for states in the residual nuclei. All j-assignments are in agreement with previous assignments except for the assignment to the 3.80 MeV level in Fe-55. Dissert. Abstr.

N71-27828 Mississippi Univ., University.
THE THIRD ORDER ELASTIC CONSTANTS OF STRONTIUM TITANATE
James Earl Mackey (Ph.D. Thesis) 1969 88 p
Avail: Univ. Microfilms Order No. 70-11491

Combinations of the third-order elastic constants of strontium titanate were measured at room temperature by the ultrasonic wave distortion method at a fundamental frequency of approximately 30 MHz. The constant C 111, was also measured for potassium chloride, and the value, -7.2 + 0.7 × 10 to the 12th power dynes per sq cm, was in excellent agreement with other measured values of the constant. The values obtained for three combinations of strontium titanate constants were -5.0 + 0.5, -5.7 + 0.6, and -2.8 + or − 0.3, respectively, in units of 10 to the 13th power dynes per sq cm. The Cauchy relations extended to third-order, C112 = C166 and C144 = C123 = C456, were applied to the combinations of third-order constants and the values of the individual constants were obtained in units of 10 to the 13th power dynes per sq cm. These values were consistent with results expected if strontium titanate were principally ionically bonded. Dissert. Abstr.

N71-27829 Cornell Univ., Ithaca, N.Y.
QUANTUM KINETIC THEORY OF AN HOMOGENEOUS SYSTEM OF CHARGED PARTICLES
Tse-Journ Lie (Ph.D. Thesis) 1970 194 p
Avail: Univ. Microfilms Order No. 70-12633

The two-particle correlation function of a homogeneous quantum system of charged particles was formulated in order to establish a kinetic equation and also to derive, as a by-product, a formula for the equilibrium correlation energy. Quantum effects of particle exchange were systematically included in this formalism. The BBKGY (Born-Bogoliubov-Kirkwood-Green-Yvon) hierarchy was derived from the Hamiltonian presented in terms of second quantization operators. Through a high-density approximation, the equation for the two-particle correlation was brought into a mathematically tractable form. Its solution is given in terms of two dielectric functions. The former, shields external potentials, while the latter, shields inter-particle potentials between constituent particles of the system. Dissert. Abstr.

N71-27832# Technische Hochschule Munchen (West Germany). Teilinstitut Maier-Leibnitz im Physikdept.
[NUCLEAR AND SOLID STATE PHYSICS RESEARCH, AND INSTRUMENT DEVELOPMENT] Annual Report, 1969
Jul. 1970 187 p refs In GERMAN; ENGLISH summary (BMBW-FBK-70-10) Avail: AEC Depository Libraries

Some results from nuclear physics including measurements and calculations of (n,gamma), (n,electrons) and (n,nprime gamma)-reactions and cross sections for slow and fast neutrons are reported. Experiments in solid state physics and low temperature irradiation at the FRM include Hall effect on Al, Mossbauer effect on ferromagnetic platinum alloys and influence on electrical, magnetic and lattice properties of metals, and scattering experiments and calculations with slow neutrons on polycrystals. New apparative developments include a 1 A neutron guide tube, a monochromator with circular ringslits for lightsources of small luminosity density, Michelson spectrometer for fourier spectroscopy, measurement of half lives up to 10 seconds by the aid of a small on line computer, improvement of an arrangement for measurements of Debye-Waller factors as function of temperature, and an arrangement for activation analysis of frozen liquids by means of low temperature irradiation. Author (NSA)

N71-27833# Democritus Nuclear Research Center, Athens (Greece).
REMARKS ON THE ETA MESON YIELDS PION(0) GAMMA GAMMA DECAY RATE
G. J. Gounaris and A. Verganelakis Jan. 1971 13 p refs (DEMO-7112) Avail: AEC Depository Libraries

It is shown that a duality-FESR method to take into account high mass states in the dispersion relations for eta mesons yields pion(0) gamma gamma predicts that Gamma (eta meson yields pion (0) gamma gamma) is bigger by a factor of 50 than the prediction of any other model. Such a result seems to be favored by recent experiments. The importance of the method to the decay amplitudes for omega mesons yields 3 pion, eta meson yields pion(+) pion(-) gamma and yields pion(+) pion(-) gamma as well the relevance of the process ee yields ee pion(0) eta mesons for the study of the eta meson pion(0) gamma gamma amplitude is also discussed. Author (NSA)

N71-27834 Virginia Univ., Charlottesville.
SCINTILLATIONS IN LIQUID HELIUM BELOW 1 K
Melvyn Robert Fischbach (Ph.D. Thesis) 1969 84 p
Avail: Univ. Microfilms Order No. 70-8086

The inhibition of alpha-particle induced scintillations in superfluid helium is studied. Experimental results exhibit a steady decrease in intensity as the temperature is reduced to 0.9 K with a subsequent plateau as it is reduced further to 0.3 K. In addition, it has been found that this decrease is due to delayed photon emission. Theoretical considerations have demonstrated that a smaller decrease with decreasing temperature in He I is not attributable to reduced recombination luminescence. For temperatures below the lambda transition it has been shown that recombination may be responsible although no attempt at numerical correlation could be made. However, an experiment employing an applied electric field in the region of the alpha tracks has yielded data that enable the coefficient of recombination to be calculated. Dissert. Abstr.

N71-27835 California Univ., Berkeley.
ASYMMETRY PARAMETERS IN SIGMA HYPERON(-) YIELDS NEUTRON ELECTRON ANTINEUTRINO AND SIGMA HYPERON(+) YIELDS PROTON GAMMA
Lawrence Kenneth Gershwin (Ph.D. Thesis) 1969 123 p
Avail: Univ. Microfilms Order No. 70-13083

Pictures were taken in a hydrogen bubble chamber of the interactions of a negative kaon beam. The interferences of the resonant amplitude with those of the predominantly S-wave background produced polarized sigma hyperons in the reactions: negative kaon proton yields negative sigma hyperon positive pion, and negative kaon proton yields positive sigma hyperon negative pion. In samples of 85,000 negative sigma hyperon yields neutron negative pion decays and in 57,000 positive sigma hyperon yields proton neutral pion decays, 53 examples of negative sigma hyperon yields neutron electron antineutrino, 8 examples of negative sigma hyperon yields neutron muon antineutrino, and 61 examples of positive sigma hyperon yields proton gamma were found. Dissert. Abstr.

N71-27836 Wisconsin Univ., Madison.
POLARIZATION MEASUREMENTS FOR PROTON ELASTIC SCATTERING FROM Sr 88, Y 89, Zr 92, Mo 92, 94, AND Sn 118, 120 NEAR ISOBARIC ANALOG RESONANCES
Jerry Lynn Ellis (Ph.D. Thesis) 1970 113 p
Avail: Univ. Microfilms Order No. 70-8282

The polarization of elastically scattered protons has been measured near isobaric analog resonances. The targets and energy ranges are: Sr-88(4.5-8.6MeV), Y-80(5.7-8.4 MeV), Zr-92(4.6-8.6 MeV), Mo-92(4.1-8.7 MeV), Mo-94(4.8-8.5 MeV), Sn-118(7.0-12.1 MeV), and Sn-120(7.3-7.8 MeV). The measurements were made at mean scattering angles of 109.2 deg and 137.6 deg. The measurements on Sr-88, Zr-92, Mo-92, Mo-94, and Sn-118 were made to determine the total angular momenta J of the isobaric anologs of several low-lying states of Sr-89, Zr-93, Mo-93, Mo-95, and Sn-119 respectively. The measurements on Sr-118 and Sn-120 near 7 MeV were made to determine the elastic width for the isobaric analogs of the lowest 3/2(+) states in Sn-119 and Sn-121. Dissert. Abstr.

N71-27837 Virginia Univ., Charlottesville.
THE EFFECT OF SCATTERING RESONANCES ON THERMAL NEUTRON SPECTRA
Warren Albert Wittkopf (Ph.D. Thesis) 1969 184 p
Avail: Univ. Microfilms Order No. 70-8039

The effects of resonance scattering on thermal neutron energy spectra and absorption rates are determined for five reactor core compositions. The scattering kernels and associated neutron cross sections are evaluated by numerical methods. For expected concentrations of Xe-135, the 0.084 eV resonance scattering effect perturbs the neutron spectrum less than 0.025%, and the maximum change in integrated absorption rate is less than 0.01%. For typical concentrations of Pu-240, the 1.056 eV resonance scattering effect perturbs the neutron spectrum as much as 1.5% near the resonance energy. Dissert. Abstr.

N71-27838 Syracuse Univ., N.Y.
ANTIPROTON-NEUTRON ANNIHILATION AT REST INTO FINAL STATES OF 5 AND 6 PIONS

Patrick Edward Hagerty (Ph.D. Thesis) 1969 73 p
Avail: Univ. Microfilms Order No. 70-12779

Antiproton annihilations at rest with neutrons into final states with five charged pions are reported. The antiprotons were separated from undesired particles and brought to rest in a bubble chamber filled with deuterium, and the neutrons upon which the antiprotons annihilated were bound in the deuterium nuclei. Analysis of events in which the proton of the deuterium nucleus was invisible (5 prong events) and visible (6 prong events) yielded the branching ratios of final states with respect to all antiproton annihilations respectively. Dissert. Abstr.

N71-27842# Joint Inst. for Nuclear Research, Dubna (USSR).
MAGNETIC SPARK CHAMBER SPECTROMETER FOR THE (K(0) SUB L)-(K(0) SUB S) REGENERATION INVESTIGATIONS AT HIGH ENERGIES
S. G. Basiladze, T. V. Bespalova, V. K. Virulev et al 1970 24 p refs In RUSSIAN
(JINR-P1-5361) Avail: AEC Depository Libraries

The on-line spectrometer which consists of a magnet and magnetostrictive spark chambers triggered by a system of counters is described. The spectrometer has the invariant mass resolution of + or − 4 MeV, the space resolution of + or − 0.3 mm and the angular one + or − 0.4 mrad. Author (NSA)

N71-27869# Bordeaux Univ. (France). Lab. de Physique Theorique.
FURTHER EVIDENCES FOR EXCHANGE DEGENERACY WITH SU(3) SYMMETRY AND ABSORPTIVE CORRECTIONS IN HYPERCHARGE EXCHANGE REACTIONS
C. Meyers, Y. Noirot, M. Rimpault, and Ph. Salin Jul. 1970 31 p refs
(PTB-36) Avail: AEC Depository Libraries

All hypercharge and charge exchange reactions for meson baryon scattering were analyzed with exchange degeneracy, SU(3) symmetry, and absorptive corrections. Good agreement for polarizations and differential cross sections including the line reversed reactions kaon (−) proton yields pion(−) Sigma hyperon(+) and pion(+) proton yields kaon(+) Sigma hyperon(+) was obtained in terms of essentially one single parameter. NSA

N71-27873# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
CALCULATION OF NUCLEON ANTINUCLEON BOUND STATES FROM A RELATIVISTIC OBE MODEL AND THE MESON SPECTRUM
G. Schierholz and S. Wagner Sep. 1970 28 p refs
(DESY-70/49) Avail: AEC Depository Libraries

Nucleon-antinucleon bound states are calculated in the framework of relativistic quantum mechanics. The potential is taken from a previous treatment of nucleon-nucleon (NN) interaction with parameters adjusted to elastic NN phase shifts and pion, eta mesons, sigma, epsilon, pion and nucleon-antinucleon exchange contributions which are supplied with form factors. The NN and nucleon-antinucleon channels are related by crossing. In the case of nucleon-antinucleon and pion and omega mesons exchange contribution to the potential change sign is compared to the NN case. This way the omega mesons exchange gives rise to a repulsive core for NN and to short-range attractive forces for nucleon-antinucleon. In contrast to similar calculations by other authors the input mesons are obtained as bound states below 1000 MeV in the nucleon-antinucleon channels. In addition there are bound states, mostly between 1 GeV and NN threshold. Most of the calculated bound states are close to experimentally observed mesons. Author

N71-27874# Eidgenossische Technische Hochschule, Zurich (Switzerland).
BOSON FIELDS WITH THE LAMBDA PHI CUBED INTERACTION IN TWO, THREE, AND FOUR DIMENSIONS
Konrad Osterwalder (Ph.D. Thesis — Swiss Federal Inst. of Tech.) 1970 133 p refs
(NP-18549) Avail: AEC Depository Libraries

The lambda integral: phicubed(x):h(x) dx interaction for boson fields in 2, 3, and 4 dimensional space time is considered. The function h(x) provides a space cut off. It is shown that the renormalized Hamiltonian H sub ren exists as densely defined symmetric operator, which is not bounded from below. Authg (NSA)

N71-27875# State Committee for the Utilization of Aomic Energy, Moscow (USSR).
LAMB SHIFT AND NONLINEAR ELECTRODYNAMICS [LEMBOVSKII SDVIG I NELINEINAYA ELEKTRODINAMIKA]
B. A. Arbuzov 1969 9 p refs
(IFVE-STF-69-19) Avail: AEC Depository Libraries

It is shown that the deviation of the measurements of the Lamb shift from the theory can be ascribed to the effect of the non-linearity of the electrodynamics equations with the characteristic length being lambda sub 0 is congruent to lambda 0 10 to the minus 14th power cm. Author (NSA)

N71-27876# Nebraska Univ., Lincoln. Dept. of Chemistry.
HALOGEN ATOM REACTIONS ACTIVATED BY RADIATIVE NEUTRON CAPTURE AND Br 82m and I 130m ISOMERIC TRANSITION PROGRESS REPORT, Feb. 1970 — Feb. 1971
15 Feb. 1971 115 p refs
(Contract AT(11-1)-1617)
(COO-1617-27; PR-5) Avail: NTIS

Modifications in the design of the radiogas chromatograph used in the laboratory are described. The kinetics of the addition process of iodine to various (C5) alkene isomers in solution at 25 C was investigated. The I-127(n,gamma)I128 induced yields in iodine or iodomethane systems of pentene, 1-pentene, trans-2-pentene, or cis-2-pentene were compared. Results were also compared with yields from the reactor irradiation of molecular I-131 in solutions of the various C5 hydrocarbon isomers. Cyclopentane, benzene, and selected alkylbenzenes were probed both in the liquid and solid phases with nuclear processes induced by the neutron activation of one or more of the following species: molecular I-129, molecular I-127, Br2, ICl, and IBr. Of particular interest in each of the systems were the following: isotope effects due to (n,gamma) and (IT) processes; individual and comparative scavenging effects in the liquid phase systems of the various halogens and interhalogens; crystalline structure at 77 K, and; product distribution of organic halides. Isotope and pressure effects were studied in (n,gamma) and (IT) activated bromine reactions in gaseous CH3Br. NSA

N71-27877# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
DO K-MESON NUCLEI EXIST?
S. S. Gershtein and P. V. Shlyapnikov 1970 7 p refs In RUSSIAN
(IFVE-STF/SPK-70-30) Avail: AEC Depository Libraries

The possibility of K-meson nuclei existence on the assumption of the positive sign of the real part of KN-scattering amplitude at low energies is discussed. Author (NSA)

N71-27878# Democritus Nuclear Research Center, Athens (Greece).
A NONLINEAR EQUATION FOR THE CORRELATION FUNCTION BETWEEN AN IMPURITY PARTICLE AND A NUCLEON IN NUCLEAR MATTER
M. E. Grypeos Aug. 1970 18 p refs
(DEMO-70/19) Avail: AEC Depository Libraries

A new approach is proposed for the determination of the correlation function between an impurity particle (for example a lambda hyperon particle) and one of the particles of an infinite host medium of identical particles (taken to be the nuclear matter). By using an approximate expression in closed form for the trail energy of the Lambda hyperon-particle in its ground state in nuclear matter and applying the variational principle in a suitable way, it is shown that the Lambda hyperon-nucleon correlation function satisfies a nonlinear integrodifferential equation. This equation is further reduced to a linear integrodifferential equation by using a proper linearization procedure. It is finally shown that for large Lambda hyperon-nucleon separations an effective (reduced) mass mu* Lambda hyperon-nucleon for the Lambda hyperon-nucleon pair can be defined. Author (NSA)

N71-27879# Institute of Nuclear Physics, Krakow (Poland).
HADRON INTERACTION AT ULTRA HIGH ENERGIES [ODDZIALYWYNIE HADRONOW PRZY SKRAJNIE WISOKICH ENERGIACH]
M. Miesonwicz 1970 50 p refs Presented at the 6th Interam. Seminar on Cosmic Rays, La Paz, Bolivia, Jul. 1970
(INP-722; CONF-700708-3) Avail: AEC Depository Libraries

Recent data concerning the interaction of nucleons in the energy interval 100 GeV to 100 TeV and of pions at energies 45 GeV to 200 GeV are presented. With reference to the proposed definition of a fireball, a review of evidence for fireball production in the mentioned energy interval is given. The common general features of interaction of pions at Serpukhov energies and of cosmic ray pions at approximately 200 GeV are given. Coherent production of 3 pi and 5 pi-bodies by pions up to primary energy approximately 200 GeV is discussed. Author (NSA)

N71-27880# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
ELECTRON IRRADIATION OF Fe AND Ni [ETUDE DE L'IRRADIATION AUX ELECTRONS DU FER ET DU NICKEL]
A. Bourret 1970 2 p refs In FRENCH Presented at 7th Intern. Congr. on Electron Microscopy, Grenoble, France, 30 Aug.-5 Sep. 1970
(CEA-CONF-1680; Conf-700809-4) Copyright. Avail: AEC Depository Libraries

Nickel and iron foils were exposed to 1.5 MeV electrons in an electron microscope. In both cases dislocation loops were observed. These loops were formed by the agglomeration of interstitials produced by collisions between the electrons and the atoms of the crystal. The number of loops produced remained constant with respect to the dose. Comparison with theory indicated that, in nickel, the nucleation occurred about the impurities, while in iron, the interstitial pairs dissociated, accounting for the high doses necessary before the defects were observed. The use of additional results obtained with a Van de Graaff generator indicated that the nucleation process was no more homogeneous at 3 MeV than it was at 1 MeV. At 3 MeV there was a sensible variation between the number of loops produced and the dose, which was much greater than would be expected from the number of defects produced. Thus, it was shown that electron irradiation can directly produce nucleation centers when the average number of atoms displaced by primary collisions exceeds 1.3. Author (NSA)

N71-27881# Bari Univ. (Italy). Ist. Nazionale Di Fisica Nucleare.
GENERAL FORMULATION OF A RELATIVISTIC THEORY OF PARTICLE SUBCONSTITUENTS (QUARKS) IN TERMS OF A FIELD VECTOR INTERACTION
L. Nitti and M. Pusterla (Padua Univ.) Dec. 1970 34 p refs
(IFPTH-10/70) Avail: AEC Depository Libraries

The topics considered are the general formalism with unequal masses for the lambda quark and the n-p doublet, the equal-mass limit, computational techniques for the evaluation of higher perturbative orders, Pade formulas and their applications, and physical predictions. NSA

N71-27882# Democritus Nuclear Research Center, Athens (Greece).
IS VENEZIANO MODEL CONSISTENT WITH THE YANG-MILLS COUPLING OF VECTOR MESON FIELDS
G. J. Gounaris Jan. 1971 9 p refs
(DEMO-71/1) Avail: AEC Depository Libraries

It is shown that the assumption that the vector-mesons couple like Yang-Mills fields in a chiral Lagrangian model is consistent, in the tree approximation, with the simplest Veneziano model for the amplitudes omega meson yields 3 pions, eta meson yields pion(+) pion(-) photon, and X yields pion(+) pion(-) photon. Author (NSA)

N71-27884 Kentucky Univ., Lexington.
DIFFERENTIAL CROSS SECTIONS OF 3.0 TO 6.9 MeV NEUTRONS SCATTERED FROM C 12 AND EXCITED STATES OF C 13
William Galati (Ph.D. Thesis) 1969 117 p
Avail: Univ. Microfilms Order No. 70-12351

Thirty two elastic and nine inelastic angular distributions of the scattering of neutrons from carbon were measured in the neutron bombarding energy range 3.03 to 6.94 MeV and at angles from 15 deg to 155 deg. The incident neutrons had an energy spread of 60 KeV except in the region of the 4.93 and 5.37 MeV resonances where it was approximately 35 KeV. A biased liquid scintillator detector and time-of-flight techniques were used. The corrected cross sections have a 3-6% relative error and 5-8% absolute error. A phase-shift analysis of the whole set of elastic angular distributions has been carried out. Complex phase shifts were used above a neutron bombarding energy of 4.9 MeV, the threshold for inelastic scattering. Level parameters derived from the analysis yield the following spins and parities for excited C-13 levels. Polarizations have been calculated using phase shift values read from smooth curves drawn through the measured phase shifts. Comparisons with available polarization measurements are presented. Dissert. Abstr.

N71-27885# Atomic Weapons Research Establishment, Aldermaston (England).
ELASTIC AND INELASTIC SCATTERING OF NEUTRONS IN THE ENERGY RANGE 2 TO 5 MeV BY B 10 AND B 11
D. Porter, R. E. Coles, and K. Wyld Aug. 1970 46 p refs
(AWRE-O-45/70) Avail: AEC Depository Libraries; HMSO 7s; BIS $1.50

The results obtained for neutron excitation of the 0.717 MeV state in B-10 substantiate previous findings and in addition excitation functions were determined for the 1.740, 2.154 and 3.590 MeV states in B-10. Comparisons of the differential and integrated inelastic cross sections were made with compound nucleus calculations derived from Hauser-Feshbech theory with fluctuations (HFW) using neutron optical potentials obtained from fits to he elastic angular distributions with estimates of optical potentials for (n,p), (n,t) and (n,alpha) reaction modes included. Apart from resonance effects, agreement is fair. For B-11, the excitation of the 2.140 MeV state was determined and compared with existing data. Finally comparisons are given of the differential and integrated cross section for inelastic scattering to this state with the HFW theory utilizing the neutron optical model parameters deduced from fits to the elastic angular distributions. The rise of the cross section above threshold is shown to be much slower than that theoretically predicted. Author (NSA)

N71-27886# Lyon Univ. (France). Inst. de Physique Nucleaire.
DECAY SCHEME OF 7 MIN Lu 168
A. Charvet, R. Dufait, A. Emsellem, and R. Chery May 1970

24 p refs
(LYCEN-7030) Avail: AEC Depository Libraries

The electron-capture decay Lu-168 (7 min) yields Y-168 was investigated using Ge(Li) and Si(Li) detectors. Single, coincidence and sum gamma-ray spectra, conversion lines, and beta-gamma coincidence relations were studied. The results obtained for the ground-state band and the gamma and beta vibrational bands are in good agreement with those of earlier investigations. Above the gamma vibrational band, 16 levels are established having the following energies (in keV), spin values and parities: 1479.8(3,4); 1551.2, 3 or 4(+); 1597.8, 4(−); 1650.4, 2 or (−); 1674.1, 5 or 6(+); 1770.1, 5(−); 1819.4, 2 or 4(−); 1842.1, 5 or 6(−); 1972.8, 5 or 6(−); 1998.7, 5(−); 2110.5, (5) or 6(−); 2135.4, (4); 2203.8, (3) 4(+) 2242.9, 4(+); 2404.6 (3) 4(+); 2427.8, 4(+). The decay scheme accounts for 76 of the 110 transitions presently observed. The Q value of the electron-capture decay of Lu-168 (7 min) and the half-life of the 1998.7 keV level determined were 4360 + or − 80 keV and (12.4 + or − 1.1) × 10 to the minus 9th power s, respectively. NSA

N71-27892 California Univ., Los Angeles.
FORWARD PEAK STRUCTURE IN QUASI TWO-BODY REACTIONS AND LONG RANGE PION EXCHANGE
Paul Ronald Stevens (Ph.D. Thesis) 1969 80 p
Avail: Univ. Microfilms Order No. 70-12021

The coherent droplet model is applied with long range pion exchange to the following reactions: positive pion proton yields neutral rho meson delta(**) positive pion proton yields neutral f delta(**), negative pion proton yields neutral rho meson neutron, positive pion proton yields positive rho meson proton, negative kaon proton yields kaon*(−)(890) proton, negative pion proton yields neutral kaon*(890) neutron, proton proton yields neutron delta(++). The measured differential cross sections for -t prime less than 0.02 (GeV/c)squared exhibit a variety of behaviors: spikes and dips and no structure. The model accounts for these features. It provides fits to existing data for -t prime equal to or less than 0.3(GeV/c)squared. For positive pion proton yields neutral rho meson delta(++), long range pion exchange accounts for the shape and magnitude of the spike and the droplet model accounts for the higher t prime data. In negative pion proton yields neutral rho meson neutron, the single helicity flip pion amplitudes dominate, accounting for the dip at t prime = 0 and the peaking near t prime = -0.015 (GeV/c)squared in the 11.2 GeV/c data. The different behavior near t prime = 0 are dug mainly to the kinematic structure of pion vertex functions. This kinematic structure is discussed. It is concluded that if one helicity amplitude dominates near t prime = 0 the droplet amplitude is mainly imaginary. Dissert. Abstr.

N71-27893# Joint Inst. for Nuclear Research, Dubna (USSR).
STUDY OF THE DI-PION IN THE MASS VALUES REGION M(PION(0) PION(0)) < OR = TO 1.3
Z. S. Strugalski, I. V. Chuvilo, E. Fenyves, T. Gemesay, I. A. Ivanovskaya et al 1970 16 p refs Submitted for publication
(JINR-E1-5085) Avail: AEC Depository Libraries

The results of investigation of neutral pion−neutral pion effective mass spectrum in the mass value region M(neutral pion neutral pion) < or = 1.3 GeV are presented. A peak is observed at M(neutral pion neutral pion) = 730 MeV. Author (NSA)

N71-27894# Eidgenossische Technische Hochschule, Zurich (Switzerland).
POLARIZATION OF PROTONS INELASTICALLY SCATTERING ON Mg 24, Cr 52, AND Ni 58 [POLARISATION DER AN Mg 24, Cr 52, UND Ni 58 INELASTISCH GESTREUTEN PROTONEN]
Arthur Walter Ruh 1970 56 p refs In GERMAN
(NP-18552) Avail: AEC Depository Libraries

The polarization of protons inelastically scattered by Mg-24, Cr-52, and Ni-58 (with the residual nucleus left in its first excited state) was measured with a carbon polarimeter. The polarization of the elastically scattered protons was also measured. The energy of the incident protons was varied between 5.38 and 5.95 MeV; and the laboratory scattering angle, between 45 deg and 120 deg. Large values of the polarization were determined for the protons scattered by Mg-24; and, in agreement with the predictions of the statistical CN model, no polarization was observed for the protons inelastically scattered by Ni-58. Relatively large polarization were found in the inelastic scattering by Cr-52; this result seems to indicate a violation of the statistical assumptions. The latter had been believed to be fulfilled, since (proton, proton prime gamma) angular-correlation measurements on Cr-52 had given excellent agreement with the statistical CN theory. Author (NSA)

N71-27895 Yeshiva Univ., New York.
THE CHARGED BOSE GAS
Abraham Lock (Ph.D. Thesis) 1969 84 p
Avail: Univ. Microfilms Order No. 70-11610

Using the Bohm-Pines (BP) and Bogoliubov formalisms as well as the random phase approximation, the investigation of the charged Bose gas is extended into the intermediate densities. The ground state energy is essentially correlation energy, and is therefore negative. The expression for the plasmon spectrum does possess an energy gap; the single-particle excitation spectrum does not. Instead the latter displays a quadratic dependence on the momentum at low values of the momenta; however this latter spectrum differs from that of a noninteracting boson gas, as it gets diminshed by two multiplying factors; the first arises from a mass correction term in the residual long range particle Hamiltonian and the second stems from the macroscopic occupation of the condensed state. Moreover the expression for the single-particle excitation spectrum experiences a discontinuous jump at k sub c. Dissert. Abstr.

N71-27896# College de France, Paris. Lab. de Physique Atomique et Moleculaire.
SOME SINGULARITIES OF VECTOR FIELD THEORY [SUR CERTAINES SINGULARITES DE LA THEORIE DES CHAMPS VECTORIELS]
J. C. Houard Jun. 1970 35 p refs In FRENCH; ENGLISH summary
(PAM-70-3) Avail: AEC Depository Libraries

An attempt was made to relate the existence of a ghost with zero mass, which appears in the canonical quantization of a massive vector field coupled to a Dirac current, with the possible occurrence of a kinematical singularity in the form factors of the vector meson. To support this view a limiting process allowing one to consider this theory as the limit of a theory in which finite energy poles occur in the vertex functions was constructed. NSA

N71-27897 California Inst. of Tech., Pasadena.
THE COMPLEX ANGULAR MOMENTUM THEORY OF THE PRODUCTION OF THREE PARTICLES IN COLLISIONS OF TWO STRONGLY INTERACTING PARTICLES AT HIGH ENERGY
Gary Luxton (Ph.D. Thesis) 1970 115 p
Avail: Univ. Microfilm Order No. 70-12490

The presence of so-called anomalous singularities complicates the procedure followed relative to that used for quasi two-body scattering amplitudes. The anomalous singularities are shown to lead to exchange-degenerate amplitudes with possible poles in much the same way as normal singularities lead to the usual signatured amplitudes. The resulting exchange-degenerate trajectories would also be expected to occur in two-body amplitudes. The representation of the production amplitude in terms of the singularities of the partial wave amplitude is then developed and applied to the high energy region, with attention being paid to the emergence of double Regge terms. Certain new results are obtained for the behavior of the amplitude at zero momentum transfer

and some predictions of polarization and minima in momentum transfer distributions are made. Dissert Abstr.

N71-27898# Lyon Univ. (France). Inst. de Physique Nucleaire.
LOW ENERGY THEOREMS AND PION MESON INTERACTIONS WITH NUCLEI [LES THEOREMES DE BASSE ENERGIE ET LES INTERACTIONS DES MESONS PION AVEC LES NOYAUX]
Alain Figuresu (Ph.D. Thesis) Nov. 1970 54 p refs
(LYCEN-7081) Avail: AEC Depository Libraries

Current algebra and the partially conserved axial current hypothesis were used to study the interactions of pion mesons with nuclei. The low-energy theorems were derived from the sum rules in which the amplitudes of the pion processes appear to be the only contributions when the mass of the pion meson is assumed to be zero. The terms in the sum rule corresponding to the nuclear structure play an important role in determining the physical amplitudes. The corrections were given a physical interpretation and their relative importance estimated. The elastic scattering of pion mesons was considered and generalized for photoproduction. It was concluded that the amplitude given by the low-energy theorem could be considered as the Born approximation of the interaction. The physical amplitude was deduced from it using the pion wave distortion correction. The saturation of the sum rules obtained was in general satisfactory even though the scheme did not consider granularity effects in the nuclear structure. Author (NSA)

N71-27899# European Atomic Energy Community, Geel (Belgium). Central Nuclear Measurements Bureau.
MEASUREMENTS OF NEUTRON ELASTIC SCATTERING FROM CARBON IN THE ENERGY REGION OF 0.50 TO 2.00 MeV
N. Ahmed, M. Coppola, and H.-H. Knitter 1970 32 p refs
(EUR-4538-e) Avail: AEC Depository Libraries

Differential cross sections for the elastic scattering of neutrons from carbon were measured at primary energies between 0.50 from 2.00 MeV in steps of 50 keV. The experimental cross sections were fitted with a five term Legendre polynomial expansion. The obtained B sub L-coefficients were then fitted with suited functions of the energy in order to obtain a smooth dependence of the differential cross sections on the primary neutron energy, using a limited number of parameters. A set of recommended differential elastic cross section curves, based on the present measurements, is given. Integrated elastic cross sections were derived from the fitted B sub o-coefficients and are compared with earlier results of other workers. Author (NSA)

N71-27900# Joint Inst. for Nuclear Research, Dubna (USSR).
ANALYSIS OF PION(−) PROTON YIELDS NEUTRON PION(+) PION(−) m PION(0) (m = 1,2,3) AND PION(−) PROTON YIELDS NEUTRON 2 PION(−) m PION(0) (m = 1,2,) REACTIONS AT pc = 4 GeV ACCORDING TO THE STATISTICAL AND ANISOTROPIC MODELS
V. G. Grishin, Sh. V. Inogamov, D. K. Kopylova, V. B. Lyubimov, and B. S. Yuldashev 1970 19 p refs In RUSSIAN
(JINR-P1-5431) Avail: AEC Depository Libraries

The pion(−) proton yields neutron pion(+) pion(−) m pion(0) (m = 1,2,3) and pion(−) proton yields neutron 2 pion(−) m pion(0) (m = 1,2),.. reactions at pc = 4 GeV are analyzed in the framework of the statistical and anisotropic models. It is shown that the basic characteristics of these processes can be described by using the anisotropic model. Author (NSA)

N71-27912 Brandies Univ., Waltham, Mass.
PHENOMENOLOGICAL CURRENT ALGEBRA VERTEX
Michael Louis Wise (Ph.D. Thesis) 1969 170 p
Avail: Univ. Microfilms Order No. 70-12033

The most general vertex function determined by the current algebra is constructed. Though the vertex function of three vector currents is emphasized, the methods employed are readily generalized to other currents, higher point functions, and matrix elements of currents, where the Ward identity techniques of Schnitzer and Weinberg is used to impose the current algebra constraints. It is found that the vertex function naturally separates into two parts, a canonical part and a noncanonical part. The canonical part depends only on the propagator, while the noncanonical part depends on two partially symmetric scalar functions. Any choice of these scalar functions will yield a theory which satisfies all of the current algebra constraints. The origin of the possible breakdown of the Johnson-Low-Bjorkon theorem is investigated and a generalized Bjorken theorem is presented. Dissert. Abstr.

N71-27913# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
ANALYSIS OF MICRO CONSTITUENTS IN Zr MATRIX. 1: SIMULTANEOUS POLAROGRAPHIC DETERMINATION OF Cu AND Mo WITHOUT PRELIMINARY SEPARATION
A. Borello and G. R. Guidotti 1 Apr. 1970 12 p refs
(RT/CHI-(70)14) Avail: AEC Depository Libraries

Cu and Mo contained in 0.5% Cu−0.5% Mo−Zr alloys of nuclear interest as fuel jacketing material can be determined by dc polarography without preliminary separation. The Zr alloy is dissolved with 1:1 H2SO4 in the presence of HNO3 and HF as catalyst. After evaporating to copious fumes of SO3, the residue is diluted with an aqueous solution of 0.5 M H2SO4−0.5 M citric acid, which acts as supporting electrolyte. Polarography is then carried out. Two diffusion controlled waves were obtained due to Mo(VI) to Mo(V) and Cu(II) to Cu(Hg), and Mo(V) to MO(III) reductions, respectively. Separate calibration curves for Cu (II) and Mo(V) were used in order to calculate both concentrations. The diffusion current for Cu was obtained subtracting one half of Mo(V) diffusion current to the total diffusion current of the first wave. Cu and Mo present in the concentration range 5 × 10 to the minus 5th to 5 × 10 to the minus 3rd power M in the polarographic cell were determined together with a relative error better than + or − 1.5%. Author (NSA)

N71-27914# Joint Inst. for Nuclear Research, Dubna (USSR).
COMPILATION OF DATA ON THE REAL PARTS OF THE KAON(+ OR −) PROTON FORWARD SCATTERING AMPLITUDES
O. V. Dumbrais, T. Yu. Dumbrais, and N. M. Queen 1970 15 p refs
(JINR-E1-5259) Avail: AEC Depository Libraries

A compilation of experimentally determined values of the real parts of the forward K (+ or −) protons forward scattering amplitudes is given in a form in which these data may be used directly in analyses of forward dispersion relations. Author (NSA)

N71-27922 Carnegie-Mellon Univ., Pittsburgh, Pa.
APPLICATIONS OF THE COHERENT STATE REPRESENTATION IN THE THEORY OF MAGNETISM
Kenneth Harmon Douglas (Ph.D. Thesis) 1970 210 p
Avail: Univ. Microfilms Order No. 70-9990

For the nearest neighbor Heisenberg model with spin 1/2 a hard core repulsion is used to account for the spin statistics. The scattering of two spin waves is solved exactly in this formalism and compared to the results obtained for Dyson's ideal spin wave Hamiltonian. The coherent state approach greatly simplifies the derivation of the low temperature series for the free energy. Free energy series are also obtained by this method for the case of an anisotropic exchange interaction. The coherent state parameters are shown to be ideally suited for describing certain helical spin configuration. A model Hamiltonian for such a system is chosen and numerical estimates of the parameters made which are appropriate to Erbium. The classical theory of this system is reviewed and

rederived by means of the coherent state formalism. The close connection boson (superfluid) systems which the coherent states provide is brought out. Dissert. Abstr.

N71-27923 Pittsburgh Univ., Pa.
TWO-NUCLEON POTENTIALS AND NUCLEAR SATURATION
Michael Ivan Haftel (Ph.D. Thesis) 1969 233 p
Avail: Univ. Microfilms Order No. 70-11815

A study of the properties of nuclear matter for potentials of varying smoothness and degree of non-locality is presented. Numerical methods to handle the two-body and nuclear matter problems for general non-local potentials are developed. These numerical methods are used to calculate the binding energies and saturation densities for a number of phenomenological potentials. The principle result is that nuclear saturation near the empirical energy and density depends mainly on a strong tensor force. Potentials with very weak tensor forces are found to drastically overbind nuclear matter. The force with the weakest tensor force in this study overbinds nuclear matter, giving about −30 MeV per particle compared with the empirical value of −16 MeV per particle. The strength of the short-range repulsion is found to play only a secondary role in nuclear saturation. Dissert. Abstr.

N71-27924# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation.
POLARIZATION OF SECONDARY PROTONS IN PROTON PROTON YIELDS PION(+) PROTON NEUTRON AND PROTON PROTON YIELDS PION(0) PROTON PROTON REACTIONS AT 669 MeV
L. S. Azhgirei, I. K. Vzorov, V. N. Zhmyrov, A. S. Kuznetsov, M. G. Meshcheryakov et al 1970 18 p refs In RUSSIAN
(JINR-P1-5293) Avail: AEC Depository Libraries

At 8.3, 14.5 and 18.0 deg angles the polarization was measured for secondary protons emitted with energy of about 370 MeV in the pp yields pion(+)pn and pp yields pion(0)pp reactions at incident proton energy of 669 MeV. In the direction of the normal to the plane, containing the momentum vectors of incident and detected protons, the polarization values are found to be: P (8.3 deg) = 0.20 + or − 0.05; P (14.5 deg) = 0.21 + or − 0.05 and P (18.0 deg) = 0.15 + or − 0.05. The obtained results can be described by the one-pion exchange model, in which the pion form factor of nucleons and the peculiarity in the behavior of the S sub 11-state amplitude of pion-N-system outside the mass surface are taken into account. Author (NSA)

N71-27925*# Georgia Inst. of Tech., Atlanta.
FORMATION OF METASTABLE HYDROGEN ATOMS BY CHARGE TRANSFER
R. L. Fitzwilson and E. W. Thomas [1970] 19 p refs Sponsored in part by NASA and AEC
(NASA-CR-118863; ORO-2591-52) Avail: NTIS CSCL 20H

Measurements are presented of the total cross sections for formation of metastable hydrogen atoms by charge transfer as protons traverse targets of helium, argon, nitrogen, and oxygen. Projectile energies range from 4 to 26 keV. An H(+) beam was directed into cell containing the target gas and emerged into an evacuated region where the metastable-state content was determined. The H(2s) flux was monitored by electric field mixing of this state with the 2p level and detection of the resulting Lyman-alpha photon. The relative variation of cross section with projectile energy for targets of H and Ar is in agreement with previous work. For oxygen the cross section increases with energy from 4 to 10 keV and remains constant from 10 to 26 keV; for nitrogen the cross section increases monotonically with increasing energy. Author (NSA)

N71-27928# Democritus Nuclear Research Center, Athens (Greece).
ESTIMATE OF THE BINDING ENERGY OF O 16 WITH MATRIX ELEMENTS OF EFFECTIVE INTERACTION
M. E. Grypeos Dec. 1970 12 p refs
(DEMO-70/25) Avail: AEC Depository Libraries

An estimate of the binding energy of O2 nucleus is given using matrix elements of effective interaction determined by means of a variational method with a healing condition. A minimum condition is also derived for these matrix elements. Author (NSA)

N71-27930# National Accelerator Lab., Batavia, Ill.
HIGH RESOLUTION CERENKOV COUNTER
Yu. P. Gorin et al [1971] 16 p refs Transl. into ENGLISH from Russian report IHEP-69-63 Sponsored by AEC
(NAL-tr-2; IHEP-69-63) Avail: NTIS

A gas Cherenkov threshold counter with a velocity resolution delta = 0.0000065 and 5 m in length is described. The resolution of delta = 0.0000036 was achieved as the result of summarizing the signals from two counters. High velocity resolution was obtained due to the effective registration of Cerenkov light in the shortwave region (counter spectral range is 180 to 600 nm). The threshold counter characteristics were investigated on 5 to 60 GeV/c beams of the 70-GeV accelerator. The particle registration efficiency on the plateau is more than 99.99994%. The probability of the particle registration below the Cherenkov radiation threshold is less than 0.0003. Author (NSA)

N71-27931*# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
RESONANCE IN THE REACTIONS KAON(−) PROTON YIELDS SIGMA(+ OR −) PION(− OR +) BETWEEN 440 AND 1230 MeV/c [FORMATION DE RESONANCES DANS LES REACTIONS KAON(−) PROTON YIELDS SIGMA (+ OR −) PION(− OR +) DE 440 A 1230 MeV/c]
Pierre Granet (Ph.D. Thesis − Paris Univ., Orsay, France) Oct. 1970 133 p refs In FRENCH
(CEA-R-4068) Avail: AEC Depository Libraries

The analysis of the reactions presented is part of a systematic study of antikaon nucleon interactions in hydrogen bubble chambers. Analysis of energy-dependent partial waves revealed six baryonic resonances of strangeness −1 and isospins 0 and 1. These resonances can be classified in four octets of the baryonic states of the unitary symmetry SU(3); the two new Lambda hyperon resonances found were assigned to the two 0-hypercharge baryons missing in the octets 3/2(−) and 5/2(−). Finally the branching ratio of the nonleptonic decay of the Sigma hyperon(+) and the Sigma hyperon (+ or −) lifetimes were accurately determined. Author (NSA)

N71-27932# United Kingdom Atomic Energy Authority, Harwell (England).
CESIUM BEHAVIOUR IN LIQUID SODIUM: THE EFFECT OF CARBON
W. S. Clough and S. W. Wade Jul. 1970 20 p refs
(AERE-R-6481) Avail: AEC Depository Libraries

The formation of stable cesium-graphite compounds reduces the escaping tendency of cesium to less than that of iodine in liquid sodium. The cesium forms two compounds, one of which is relatively unstable in liquid sodium and is probably a surface adsorption compound. The more stable fraction of the adsorbed cesium is probably a lamellar cesium-graphite compound and is almost fully stable in vacuum at 500 C in the absence of sodium. The rate of reaction for the breakdown of the more stable cesium-graphite compound in sodium was measured over a range of temperatures, and the corresponding activation energy was calculated. Graphite was found to be equally effective for cesium sorption when it is used in the gas phase above the liquid sodium. Charcoal was found to be even more efficient than graphite in trapping cesium, and the cesium−charcoal compound which is formed is almost fully stable in sodium at 500 C and in air at the same temperature. Author (NSA)

N71-27937 California Univ., Berkeley.
THE CHARGED PION LIFETIME MEASURED IN FLIGHT
Arthur Joel Greenberg (Ph.D. Thesis) 1969 161 p
Avail: Univ. Microfilms Order No. 70-13058

The lifetime of the charged pion was found by determining, as a function of distance, the number of surviving pions in a narrow beam. Measurements for both positive pions and negative pions were made along a 35-ft decay path, equivalent to 0.8 lifetime, using a movable pion detector. The monitor counters defining the beam were designed so that the measured attenuation with distance was due solely to pion decay and not to loss of scattered particles. The attenuation together with the pion velocity, derived from a precise time of flight measurement, determined the lifetime. The movable counter and the pion detector in the monitor system were differential Cerenkov counters with a liquid hydrogen radiator. The lifetime measured in this experiment with pions in flight, 26.02 + or - 0.04 nsec, is in agreement with other equally precise experiments with positive pions at rest. Comparison of the lifetimes measured with pions in these two states of motion is relevant to the question of microcausality in field theory.
Dissert. Abstr.

N71-27938# Brookhaven National Lab., Upton, N.Y.
RELATIVE MEASUREMENTS OF ANTINUETRINO IN THE U 235 AND Pu 239 FISSION INDUCED BY RESONANCE NEUTRONS
Yu. V. Ryabov et al Jan. 1971 21 p refs Transl. into ENGLISH of Russian report JINR-P3-5297
(BNL-TR-401; JINR-P3-5297) Avail: NTIS

The variation in the average number of neutrons per fission event from resonance to resonance in U-235 and Pu-239 was examined. Measurements were performed using time-of-flight techniques in the fast pulsed reactor. Results of the measurements are presented and discussed.
NSA

N71-27939 Clemson Univ., S.C.
THE GENERAL COVARIANT, NONDIVERGENT EQUATIONS OF MOTION OF A CHARGED PARTICLE
Barry Leeds Illman (Ph.D. Thesis) 1969 114 p
Avail: Univ. Microfilms Order No. 70-6274

A derivation of the equations of motion (including self-field effects) of a charged particle has been found in which divergent terms, and the subsequent mass renormalization, are conspicuously absent. All fields, including the gravitational field of the particle, must satisfy the Einstein-Maxwell field equations, which are derivable in the usual manner from a variational principle. The invariance of the action integral under infinitesimal coordinate transformations and the existence of the field equations leads to a surface integral independent of the surface parameters. By choosing a surface which surrounds, but does not enclose, the world line the surface integral is evaluated and the generally covariant equations of motion are obtained. An investigation of the surface integral suggests that the self-energy stored in the Coulomb field is just balanced by the particle's metrical field.
Dissert. Abstr.

N71-27941 Texas A&M Univ. College Station.
DIRECT NUMERICAL SOLUTION OF THE SCHRODINGER EQUATION FOR H3
Benny Joe Hill (Ph.D.thesis) 1969 122 p
Avail: Univ. Microfilms Order No. 70-11546

The importance of the three nucleon problem to understanding the nucleon-nucleon interaction is studied. The general formulation of the three nucleon problem is discussed. A reduction of the problem to a coupled set of two dimensional equations with hard core potentials is given. Calculations in the two dimensional formulation are given showing difficulties with the two dimensional approach. Alternatives are given for a direct solution of the Schrodinger equation with hard core potentials including a discussion of the problem in three dimensions.
Dissert. Abstr.

N71-27942 Missouri Univ., Rolla.
A STUDY OF THE ENERGY LOSS SPECTRA INDUCED BY IMPACT OF 25 - 125 keV PROTONS ON HELIUM ATOMS
Franklin Dean Schowengerdt (Ph.D. Thesis) 1969 191 p
Avail: Univ. Microfilms Order No. 70-11761

Results of a study of the inelastic energy loss spectra induced by the impact of protons on gaseous helium at energies of 25 to 125 keV are reported. The spectra were obtained by sending an accelerated beam of protons through a chamber containing the helium target gas, mass analyzing the forward scattered beam, then decelerating the beam to a low, well defined energy for energy analysis and detection. The accelerating potential was varied to produce the spectra. The total cross sections for inelastic scattering show agreement with theory similar to that found in the case of ionization. The partial ionic stopping powers fall below the total stopping powers, the differences increasing at lower impact energies, where charge exchange is more probable.
Dissert. Abstr.

N71-27943 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE PARTICLE SPECTRUM IN NUCLEAR MATTER CALCULATIONS
Haipo-Wen Kao (Ph.D. Thesis) 1969 116 p
Avail: Univ. Microfilms Order No. 70-12430

The effect of energy spectrum on the nuclear matter binding energy was considered. An accurate solution of the Bethe-Goldstone equation was obtained, from which the reference spectrum reaction matrix G sub r was evaluated. The equation relating the reaction matrix G to the G sub r by matrix inversion was then solved. The Pauli operator was treated and the off-energy shell effect was also treated by achieving a self consistent energy spectrum for the two intermediate states. The particle energy was defined to cancel the bubble insertion, and the hole energy was evaluated from on-energy -shell matrix elements. Self consistency of both the energy spectrum and the reaction matrix was obtained by iteration. The convergence was found to be fast and well behaved. The binding energy per particle for the nuclear matter system was determined. The result shows a gain of 4 MeV per particle for the binding energy at K sub F = 1.4 f/m.
Dissert. Abstr.

N71-27944# United Kingdom Atomic Energy Authority , Risley (England).
SNAP: A TWO DIMENSIONAL NEUTRON DIFFUSION CODE
C. W. J. McCallien 1970 76 p refs
(TRG-1990) Avail: AEC Depository Libraries; HMSO 10s; BIS $2.00

SNAP is a FORTRAN 4 program that solves the finite difference form of the group diffusion equations in one or two dimensions. The four coordinate systems (x,y), (r,z), (r,theta) and one-dimensional spherical are allowed. Mesh points are positioned at the centers of cells of constant composition. In the (x,y) case the cell is cells may be rectangles, or equal equilateral triangles, or equal regular hexagons. In (r,z) the cells are rectangular. In (r,theta) each cell is bounded by two radii and two concentric arcs. Numerous symmetry options are available. Extrapolation lengths can be specified at internal and external boundaries. Up to sixty energy groups are allowed. Options include adjoint problems, fixed source problems and the determination of the critical buckling or critical cell sizes.
Author (NSA)

N71-27945 California Univ., Berkeley.
A STUDY OF THE SURFACE OF PLATINUM BY LOW ENERGY ELECTRON DIFFRACTION AND MOLECULAR BEAM SCATTERING
Donald Leonard Smith (Ph.D. Thesis) 1969 233 p
Avail: Univ. Microfilms Order No. 70-13172

The study of porous industrial catalysts is made difficult by the complex geometries involved and by the uncertain structure and composition of the surfaces. A fundamental understanding of

catalysis is more likely to be obtained by using pure single-crystals under scrupulously clean conditions. A Pt(111) surface was studied in an environment of 10 to the minus 10th power torr after cleaning it by ion bombardment and annealing. Sharp specular scattering of dc helium and deuterium beams and sharp low-energy electron diffraction patterns indicated a high-quality surface containing very little contamination or distortion. Contamination from chamber background gases was periodically removed by flashing the crystal. It is believed that the techniques of molecular and electron scattering, when used under ultrahigh vacuum conditions, have great potential for the study of heterogeneous catalysis on a fundamental level. Dissert. Abstr.

N71-27947# Padua Univ. (Italy). Inst. Di Fisica.
THE ANNIHILATION ANTIPROTON NEUTRON YIELDS PION(+) PION(−) PION (−) BETWEEN 1.0 AND 1.6 GeV/c AND ITS COMPARISON WITH THE VENEZIANO MODEL
A. Bettini, M. Cresti, M. Mazzucato, L. Peruzzo, S. Sartori et al Sep. 1970 18 p refs
(INFN-PD-70/2) Avail: AEC Depository Libraries

The reaction antiproton neutron yields pion(+) pion(−) pion(−) between 2.08 GeV c.m. energy was analyzed. The population of the 3 pion Dalitz plot (a total of 2328 events at all energies) is strongly nonuniform and shows a structure that can be qualitatively interpreted with simple Veneziano type formulae. The moments of the angular distributions of the three-pions plane are also examined. Author (NSA)

N71-27951# Institute of Nuclear Research, Warsaw (Poland).
[NUCLEAR PHYSICS AND CHEMISTRY, AND REACTOR TECHNOLOGY] Annual Report, 1969
[1970] 204 p refs In POLISH
(INR-1180) Avail: AEC Depository Libraries

Research in the areas of nuclear physics, nuclear chemistry, reactor technology, isotope technology and radiometric instruments, and plasma physics is briefly summarized. Publications issued during this period are listed. NSA

N71-27952# Cekmece Nuclear Research Center, Istanbul (Turkey).
NORDHEIM EQUATION ACCORDING TO P1 APPROXIMATION
Cetin Ertek, Sarman Gencay, and Yurtcan Guersu Dec. 1969 10 p refs
(CNEAM-73) Avail: AEC Depository Libraries

A Nordheim type equation relating the reactivity to the stable and transient periods of the reactor is established in the frame of P2-approximation. Its characteristics are investigated and compared to the same kind of equation given by elementary diffusion theory. Author (NSA)

N71-27953# Japan Atomic Energy Research Inst., Tokyo.
Pu 239 FISSION PRODUCT YIELDS AND THEIR INFLUENCE ON FAST REACTOR CHARACTERISTICS
Akira Hasegawa, Tatsuzo Tone, Satoru Katsuragi Oct. 1970 81 p refs In JAPANESE; ENGLISH summary
(JAERI-4165) Avail: AEC Depository Libraries

Considering the incident neutron energy dependence of Pu-239 fission products (F.P.) mass-yield curve, pseudo fission product cross sections were produced and the effects on the long term burnup characteristics of a typical fast reactor were examined. It is shown that detailed study of local structure around the peaks of yield curve rather than the valley is essential, and the variation of the yield due to incident neutron energy should be taken into account, especially, for predicting characteristics after high burnup. For producing the F.P. group constants in the future, the status for the yield data and Benzi's procedure of evaluating F.P. neutron capture cross sections were reviewed in detail. Author (NSA)

N71-27954 California Inst. of Tech., Pasadena.
EXCITATION ENERGIES AND DECAY PROPERTIES OF T = 3/2 STATES IN O 17, F 17 AND Na 21
Arthur Bruce McDonald (Ph.D. Thesis) 1970 170 p
Avail: Univ. Microfilms Order No. 70-12446

The two lowest T = 3/2 levels in Na-21 were studied in the F-19(He-3,n) Ne-20(p,p), and Ne-20(p,p') reactions, and their excitation energies, spins, parities, and widths were determined. In a separate investigation, branching ratios were measured for the isospin-nonconserving particle decays of the lowest T = 3/2 levels in O-16 and F-17 to the ground state and first two excited states of O-16, by studying the N-15(He-3,n) F-17*(p)O-16 and O-18(He-13,alpha)O-17*(N)O-16 reactions. The F-19(He-3n)Na-21 reaction was studied at incident energies between 4.2 and 5.9 MeV using a pulsed-beam neutron-time-of-flight spectrometer. Two T = 3/2 levels were identified at excitation energies of 8.99 + or − 0.05 MeV and 9.22 + or − 0.015 MeV. The spins and parities were determined by a comparison of the measured angular distributions with the results of distorted wave Born approximation calculations. Dissert. Abstr.

N71-27955 Fordham Univ., New York.
APPLICATION OF THE FULL SINGLE PAIR MODEL AND THE METHOD OF HARMONIC POLYNOMIALS TO THE STUDY OF CORE DISTORTION IN Li 6
Roger Hugh Richardson (Ph.D. Thesis) 1969 113 p
Avail: Univ. Microfilms Order No. 70-11449

Careful consideration was given to treating the effects of the Pauli exclusion principle correctly. It was found that while the core distortion predicted by the model had little effect on either the energy or the magnetic dipole moment, a very significant contribution to the electric quadrupole moment was indicated. Auxiliary expressions for the contributions to all matrix elements from a tensor force were also obtained. A feature of the results was the very large contribution of the exchange integrals arising from the exclusion principle. In many cases, these contributions were found to dominate the matrix elements. In evaluating the matrix elements, a new procedure for handling harmonic oscillator shell model calculations was developed. This procedure, called the method of harmonic polymonials, provides the analog of the Moshinsky brackets for use with uncoupled product state wave functions and makes feasible the direct reduction of arbitrary matrix elements to Talmi integrals, for both central and tensor forces. Dissert. Abstr.

N71-27957 Pittsburgh Univ., Pa.
QUANTUM ELECTRODYNAMICAL TREATMENTS OF ATOMS INTERACTING WITH RADIATION FIELDS
Ching-Sung Chang (Ph.D. Thesis) 1969 94 p
Avail: Univ. Microfilms Order No. 70-11811

A full quantum electrodynamical treatment of atoms interacting with a radiation field is presented. The formalism is applied to the following two cases: (1) the interaction between two neutral atoms by means of the exchange of a virtual photon; and (2) the interaction of a bound electron with external radiation fields of finite intensity. In (1), the Bethe-Salpeter equation for this system is solved in the ladder approximation after construction of the Green's function to order e squared. This Green's function is then applied in discussions of the nature of the interaction between neutral atoms, and of the problem of low intensity photon scattering. In (2), the Feynman-Dyson formalism is used. An equation for a bound electron in finite intensity radiation fields is constructed, such as those encountered in early molecular beam experiments and in recent masers and lasers. The Green's function for the equation so obtained is used to compute the induced transition probabilities for various systems of interest. Dissert. Abstr.

N71-27958# Commissariat a l'Energie Atomique, Bruyeres-Le-Chatel (France). Centre d'Etudes.
INTERMETALLIC DIFFUSION OF PLUTONIUM IN Pu-Cu

AND Pu-U SYSTEMS: INFLUENCE OF A THIRD ELEMENT [DIFFUSION INTERMETALLIQUE DU PLUTONIUM DANS LES SYSTEMES Pu-Cu ET Pu-U: INFLUENCE D'UN TROISIEME ELEMENT]

Christian James (Ph.D. Thesis — Lyon Univ.) Oct. 1970 171 p refs In FRENCH

(CEA-R-3951) Avail: AEC Depository Libraries

The diffusion of plutonium is described in the systems Pu—Cu. Pu sub delta—Cu; Pu sub delta Ga—U; and Pu—U in the presence of nickel. It was found in the absence of Ga, only the compounds PuCu2, PuCu4 and PuCu11 are formed in the Pu—Cu diffusion zones at a temperature of 500 C and for very long treatments. In the presence of Ga, in the Pu sub delta Ga—Cu system a new ternary compound Pu(CuGa)3, unknown until now was found for Ga contents of above 2%. It can be isolated as a single phase by melting Pu, Cu, and Ga in an arc furnace. In the ternary equilibrium diagram, this compound shows a region of stability which widens with increasing temperature. There exists a very wide solid solution region for Ga in the binary compound PuCu2 giving Pu(CuGa)2; this region is much smaller in PuCu4. The intermetallic compounds present in the diffusion zones are hard, brittle, and highly sensitive to oxidation. Author (NSA)

N71-27965# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

APPLICATION OF PHOTO-ELECTRON SPECTROSCOPY TO CHEMICAL ANALYSIS [LA SPECTROSCOPIE PHOTO-ELECTRONIQUE APPLIQUEE A L'ANALYSE CHEMIQUE]

H. Lemaire 1970 16 p refs In FRENCH Presented at the Conf. on the Doping of Interstitial Elem. and Their Influence on the Properties of Metals and Alloys, Grenoble, France, 29—30 Oct. 1970

(CEA-CONF-1725; CONF-701036-1)

A renewed interest in the use of electron spectroscopy for chemical analysis (ESCA) results from considerable improvements made in beta spectrometer resolution. Irradiation of a material with photons of energy hmu liberates groups of photo-electrons of kinetic energy C sub i given by C sub i = hmu — L sub i where L sub i is the binding energy of the electrons within the materials. The ESCA spectra will thus exhibit as many lines as there are electronic levels with energies less than hmu. In particular, the analysis of deep lying levels allows quantitative and qualitative analysis of the material under consideration to be made. NSA

N71-27964 California Inst. of Tech., Pasadena.

A STUDY OF THE DYNAMICS OF TRIPLET EXCITONS IN MOLECULAR CRYSTALS, 1. AN INVESTIGATION OF DELAYED LIGHT EMISSION FROM CHLORELLA PYRENOIDOSA, 2

Eldon Bruce Priestley (Ph.D. Thesis) 1970 311 p

Avail: Univ. Microfilms Order No. 70-12496

Phosphorescence spectra of pure crystalline naphthalene at room temperature and 77 K are presented. The lifetime of the lowest triplet B-3 sub 1u state of the crystal was determined from measurements of the time-dependence of the phosphorescence decay after termination of the excitation light. The fact that this lifetime is considerably shorter in the pure crystal at room temperature than in isotopic mixed crystals at 4.2 Kis discussed, with special importance being attached to the mobility of triplet excitons in the pure crystal. Excitation spectra of the delayed fluorescence and phosphorescence from crystalline naphthalene and anthracene are also presented. An apparatus capable of measuring emission lifetimes in the range 5 × 10 to the minus 9th power sec to 6 × 10 to the minus 3rd power sec is described in detail. The capabilities of the equipment are adequately demonstrated by the results of a determination of the fluorescence lifetime of 5,6,11,12-tetraphenylnaphthacene in benezene solution and Chlorella pyrenoidosa at room temperature. Details of numerical methods used in the final data reduction are also described. Dissert. Abstr.

N71-27966# Japan Atomic Energy Research Inst., Tokyo

ESTIMATION OF FISSION PRODUCT DECAY HEAT

Nobuo Sasamoto and Kenji Tasaka Nov. 1970 46 p refs In JAPANESE; ENGLISH summary

(JAERI-Memo-4205) Avail: AEC Depository Libraries

Bateman's equation and its integral form were used repeatedly to get analytically the time dependent concentration of each fission product nucleus. With these data, fission product decay heat was analyzed. In analysis, two kinds of data about released energy at every disintegration of fission product were used, one was the sum of beta-ray and gamma-ray energy and another was the Q sub beta value. It was shown that an obvious discrepancy between the results for the cooling time interval zero to nearly 100 sec and that the results were in good agreement with others. The ratio of beta-ray decay heat to gamma-ray decay heat was also analyzed. As a result, it was seen that beta approximately equaled gamma beta was > than gamma at zero cooling time, beta was < or = to gamma from zero up to 10 to the 7th power cooling time and beta approximately equaled gamma beta was > gamma after 10 to the 7th power sec cooling time. In addition to the analysis of the decay heat, the progress of studies on fission product decay heat is reviewed. Author (NSA)

N71-27968# United Kingdom Atomic Energy Authority, Harwell (England). Health Physics and Medical Div.

RADIOACTIVE FALLOUT IN AIR AND RAIN: RESULTS TO THE MIDDLE OF 1970

R. S. Cambray, E. M. R. Fisher, W. L. Brooks, and D. H. Peirson Nov. 1970 53 p refs

(AERE-R-6558) Avail: AEC Depository Libraries; HMSO 8s; BIS $1.60

Samples of atmospheric dust and rainwater were collected from the U.K. and elsewhere. Results are presented of analyses of these samples for various fission products and certain other radionuclides. The concentrations of the long-lived fission products Cs-137 and Sr-90 in air in the U.K. were, in the first half of 1970, about 20% greater than for the first half of 1969; the deposition and concentration in rainwater were also somewhat greater than in 1969. The Chinese explosion of 29th September 1969 contributed about 70% of the long-lived activity in the summer of 1970. An estimate was made of the worldwide deposition of Sr-90 in rain to the end of 1969. Measurements in air in the southern hemisphere showed that, in mid-1970, about 80% of the long-lived activity was contributed by the French tests held in the South Pacific in 1966. Long-term estimates were made of washout factor and the velocity of dry deposition. Measurements of short-lived fission products from the Chinese explosion of 29th September 1969 and the French Tests of May-July 1970 are given in an appendix. Author (NSA)

N71-27967# College de France, Paris. Lab. de Physique Atomique et Moleculaire.

RELATIVISTIC EXTENSION OF THE LE COUTEUR AND NEWTON FORMALISM. 8: DETERMINANTAL FORMALISM AND PHYSICAL UNITARITY [EXTENSION DU FORMALISME DE LE COUTEUR ET NEWTON AU CAS RELATIVISTE. 8: FORMALISME DETERMINANTAL ET UNITARITE PHYSIQUE]

M. Benayoun and Ph. Leruste Apr. 1970 31 p refs In FRENCH; ENGLISH summary

(PAM-70-1) Avail: AEC Depository Libraries

Topics concerning the assumption of physical unitarity were examined. It was essentially proved that the general description of the n-channel scattering needs n many valued meromorphic functions. Only a part of the set of the branches of these functions was shown to appear in the physical quantities. A special consequence

of the physical unitarity was examined. Under this hypothesis the physical quantities of the second elastic channel may diverge at the second threshold energy in the 2 channel scattering problem.
NSA

N71-27969 North Carolina Univ., Chapel Hill.
NUCLEAR MAGNETIC RELAXATION IN LIQUID CDF3
James Waitus Harrell, Jr. (Ph.D. Thesis) 1969 70 p
Avail: Univ. Microfilms Order No. 70-12063

The longitudinal relaxation times of the deuterium and fluorine nuclei in liquid CDF3 were measured by pulsed magnetic resonance techniques at temperatures between 112 K and 188 K. The results obtained for CDF3 were combined with results obtained for liquid CHF3 in a previous study by means of relaxation and Overhauser effect measurements in order to calculate the rotational diffusion coefficients, D perpendicular and D parallel, and to more effectively obtain the individual contributions to the relaxation in CDF3 and CHF3. The accuracy of the analysis, in particular the accuracy in the calculated values of D parallel, was limited by the lack of an accurate knowledge of the quadrupole coupling constant in CDF3, and by the lack of an accurate knowledge of how the contribution to the relaxation in CHF3 from proton-fluorine intermolecular dipole-dipole interactions is related to the contribution from proton-proton intermolecular dipole-dipole interactions.
Dissert. Abstr.

N71-27970 Pittsburgh Univ., Pa.
COULOMB EXCITATION STUDIES OF Ba 134, Ba 136, Ba 138, AND Nd 150
John Richard Kerns (Ph.D. Thesis) 1969 93 p
Avail: Univ. Microfilms Order No. 70-11816

Using O and alpha beams from the Tandem Van de Graeff accelerator, the angular distribution of the ratio of scattered ions exciting the first 2(+) state to elastically scattered ions was measured. Values of the reduced transition probability B(E2,O(+) yields 2(+)) and the static quadrupole moment Q2(+) of the first 2(+) state were determined. The B(E2,O(+) yields 2(+)) values obtained are .672 + or − .016, 418 + or − .011, .221 + or − .009 and 2.72 + or − .06e(2) barn(2), for Ba-134, Ba-136, and Nd-150, respectively. The static quadrupole moments of the first 2(+) state of these nuclei are found to be −.58 + or − .26, −.08 + or − .36, −.11 + or −.15, and −1.34 + or −.54 e x barn, respectively.
Dissert. Abstr.

N71-27971# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON THE BOUND STATES OF THE RELATIVISTIC THREE PARTICLE SYSTEM
A. Atanasov 1970 14 p refs In RUSSIAN
(JINR-P2-5336) Avail: AEC Depository Libraries

In the quasi-potential approach the problem of determination of the board state masses in the three particle system with the quasi-pair interaction is reduced to the analysis of the eigenvalues of the Hermitian operator. Under some assumptions, concerning two particle interactions, an estimate is obtained for the upper limit of the bound state number and for the algorithm of the approximate calculation of the bound state masses.
Author (NSA)

N71-27972# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
ELECTRON SPIN RESONANCE STUDY OF DEFECTS PRODUCED BY IRRADIATION IN AN IONIC SOLIDS BERYLLIUM OXIDE [ETUDE PAR RESONANCE PARAMAGNETIQUE ELECTRONIQUE DES DEFAUTS CREES PAR IRRADIATION DANS UN SOLIDE IONIQUE: L'OXYDE DE BERYLLIUM].
Alain Herve (Ph.D. Thesis − Grenoble Univ.) Dec. 1970 160 p refs In FRENCH
(CEA-R-3937) Avail: AEC Depository Libraries

Using electron spin resonance, models were established for different types of defects (donor or acceptor centers, anion and cation vacancies) created by gamma or neutron irradiation in single crystals of beryllium oxide. It is shown that ionizing radiation liberate electrons and holes that are trapped by imperfections in the lattice (impurities, vacancies) and that neutron bombardments produce displacements of atoms in the crystal lattices.
Author (NSA)

N71-27973# Joint Inst. for Nuclear Research, Dubna (USSR).
TRANSITION RADIATION ON RESONANCE GAMMA-QUANTA
E. A. Pereistein and M. I. Podgoretsky 1970 11 p refs In RUSSIAN; ENGLISH summary
(JINR-P2-5042) Avail: AEC Depository Libraries

The effect of the absorption nuclear lines on the transition radiation of resonance gamma quanta by relativistic electrons passing through a plate of a finite thickness is considered. It is shown that the radiation intensity inside the absorption line can considerably exceed the intensity outside the line.
Author (NSA)

N71-27976# Atomic Energy Commission, Washington, D.C. Div. of Reactor Development and Technology.
PROCEEDINGS OF THE ELEVENTH AEC AIR CLEANING CONFERENCE, VOLUME 1
Melvin W. First and James M. Morgan, Jr., eds. Dec. 1970 458 p refs Conf. held at Richland, Wash., 31 Aug.−2 Sep. 1970
Prepared in cooperation with Harvard Univ., Boston
(CONF-700816-Vol-1) Avail: NTIS HC$6.00/MF$0.95

The discussions on the removal of radioactive aerosols from the envirnoment are presented. Some of the included topics are: activated carbon supported isotope exchange processes, design of filtered ventilation systems, design of fission gas absorption beds, design of fission gas holdup systems, thermal conductivity of layers of sodium combustion products, Kr-85 detectors, and release of radioactivity following loss-of-coolant accidents.
F.O.S.

N71-27979 Johns Hopkins Univ., Baltimore, Md.
FOUR-PRONGED ANTIPROTON-DEUTERIUM INTERACTIONS AT 7.0 GeV/c
Gerald Joseph Goodman (Ph.D. Thesis) 1969 197 p
Avail: Univ. Microfilms Order No. 70-11786

The following four-pronged final states are investigated and the accompanying cross sections for visible spectator events are found: (1) pion(−) antiproton pion(+) (p) n, 889 + or − 29 microbarn; (2) pion(−) antiproton pion(+) d, 204 + or − 10 microbarn; (3) pion(−) p(p), 329 + or − 14 microbarn; (4) pion(−) antiproton p(p) pion(0), 519 + or − 19 microbarn; (5) pion(−) pion(−) p(p) antineutron, 334 + or − 14 microbarn. Reaction (1) exhibits the existence of two distinct enhancements in the anti-Delta hyperon(2-) pion(+) effective mass distribution at 1470 and 1750 MeV, and a broad peak around 2250 MeV in the spectator p n pion(+) mass spectrum. Reaction (2), an example of coherent scattering, shows copious anti-Delta hyperon(2-)(1238) production, and a substantial amount of enhancement around 2170 MeV in the d(+) effective mass distribution. The most interesting aspect of reaction (3) comes in the pion(−) antiproton mass spectrum; clearly distinguishable are the Delta hyperon(1238) and (1930) resonances. Reaction (4) shows much Delta hyperon(1238) production in various charge states. In reaction (5), the production of Delta hyperon(0) and anti-Delta hyperon(2-t) is noted.
Dissert. Abstr.

N71-27980# Kernforschungszentrum, Karlsruhe (West Germany).
DETERMINATION OF THE CRITICAL CURRENT IN A SECTION WITH RADIAL SLOTS IN THE IRIS DISK [BESTIMMUNG DES KRITISCHEN STROMS IN EINER SEKTION MIT RADIALEN SCHLITZEN IN DEN IRISSCHEIBEN]

A. I. Zykov et al [1970] 6 p refs Transl. into GERMAN from the Russian report In GERMAN
(KFK-TR-335; KHFTI-69-25) Avail: AEC Depository Libraries

A beam of accelerated electrons penetrating an iris-loaded waveguide produces nonrotational symmetrical waves of the higher modes. These waves cause a transverse amplification of the beam electrons leading to its destruction under certain conditions. The value of the current in the beam at which destruction occurs is called the critical current. The critical current was calculated for a section of the 2-GeV accelerator with radial slots in the iris disk. The results showed that with the help of a single section with radial slots in the iris disk the accelerated current can be increased at least tenfold, and it was established at W sub 0 = 40 MeV the critical current of the single section was not less than 1.5 amp. It is emphasized that this current value in the single section can not be accelerated to W sub 0 = 40 MeV, but is only a stability measurement. NSA

N71-27981# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
TIME RESOLUTION OF SCINTILLATION COUNTERS [VREMENNOE RAZRESHENIE STSINTILLYATSIONNYKH SCHETCHIKOV]
S. V. Donskov and R. S. Shuvalov 1970 15 p refs In RUSSIAN
(IFVE-SEF-70-23) Avail: AEC Depository Libraries

In the frame of ideal photomultipliers the time resolution calculations are made for the following modes:(1) the gravity center of pulse; (2) the point of crossing by the integrated pulse current, varying proportionally to the number of emitted photo-electrons; (3) the threshold discriminator; and (4) the threshold discriminator with the correction for the average time when approaching the given level. The calculations have been made for Poisson and uniform distribtuions. The best time resolution is obtained for the last of the listed modes. Author (NSA)

N71-27984# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
UNITARY REPRESENTATIONS OF THE CONFORMAL GROUP
A. N. Leznov and I. A. Fedosseev 1969 17 p refs In RUSSIAN; ENGLISH summary
(IFVE-STF-69-85) Avail: AEC Depository Libraries

Explicit expression of the invariant Hermitian form for all representations of the conformal group is found for which it exists. Unitary representations are selected by the condition of positive definiteness of the form. Author (NSA)

N71-27986# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuetron Physics.
INVESTIGATION OF THE PROTON POLARIZATION IN THE REACTION C-12(He-2, PROTON SUB 0)N-14
G. Eler, M. I. Krivopustov, H.-J. Wiebicke, F. Asfur, I. V. Sizov et al 1970 28 p refs In RUSSIAN
(JINR-P15-5158) Avail: AEC Depository Libraries

Experimental data on polarization of protons in the reaction C-12(He-2, proton)N-14(ground state) are presented. The measurements were performed with the aid of an electrostatic generator using a ring geometry polarimeter. The proton polarization values are obtained for six energies of He-3 ions in the range from 2.4 to 3.6 MeV for the angles of 20 to 70 deg (the energy and angle in the laboratory system). The analysis of experimental data is performed according to the resonance theory of nuclear reactions. NSA

N71-27988# Joint Inst. for Nuclear Research, Dubna (USSR).
EXPERIMENTS ON ALPHA PARTICLE ACCELERATION BY THE COLLECTIVE METHOD
V. P. Sarantsev, V. P. Rashevskii, A. K. Kaminskii, V. I. mironov, V. P. Fertushniyi et al 1971 13 p refs In RUSSIAN
(JINR-P9-5558) Avail: AEC Depository Libraries

The results of experiments on alpha-particle acceleration by the collective method in the Adgesator model and the technique of alpha-particle detection are presented. NSA

N71-27997# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
LOWER BOUNDS FOR THE SCATTERING PARAMETERS
B. N. Zakhariev, V. P. Permyakov, and Yu. I. Fenin 1970 14 p refs In RUSSIAN
(JUNR-P4-5332) Avail: AEC Depository Libraries

A theorem on the variational bounds for definite combinations of K-matrix elements in reactions with a rearrangement of particles is proven. Author (NSA)

N71-27998# Texas A&M Univ., College Station. Dept. of Chemistry and Cyclotron Inst.
ON-LINE ALPHA AND PROTON DECAY SPECTROMETRY Annual Progress Report, 1970
Ronald D. Macfarlane 15 Jan. 1971 21 p refs
(Contract AT(40-1)-3820)
(ORO-3820-7) Avail: NTIS

Development work was carried out on the helium-jet recoil transport system, the recoil time-of-flight mass analyzer, and the on-line mass separator using a quadrupole mass filter. Beta-delayed alpha and proton decay was studied in the light elements. Results were obtained for Na-20 which bear on the existence of second-class currents in the weak interaction and second-order interference effects in the CVC. Longitudinal nuclear alignment of recoils from G-T transitions was detected in beta-neutrino correlation measurements of the decay of Na-20. New transitions were observed in the beta decay of Al-24 and Cl-32. A detailed study of the properties of the Ac-221 nucleus using heavy ions was completed. Absolute excitation functions were obtained. A new correlation was discovered relating to the widths of the excitation functions and the dynamics of yeast level changes in successive neutron evaporations. Spectra from the Sm-149(n,alpha) reaction were studied for different chemical compounds over a range of temperatures. The ratio of excited state of Nd-146 was found to be slightly dependent on the chemistry and temperature of the target nucleus. NSA

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N71-28995# Los Alamos Scientific Lab., N.Mex.
INITIAL EQUILIBRIUM CONFIGURATION OF THE SCYLLAC 5-METER TOROIDAL-SECTOR EXPERIMENT
F. L. Ribe, W. H. Borkenhagen, W. R. Ellis, and K. S. Hanks Feb. 1971 6 p refs
(Contract W-7405-eng-36)
(LA-4597-MS) Avail: NTIS

The first portion of the Scyllac theta-pinch experiment to be placed in operation is the 5-meter toroidal sector. It provides a toroidal equilibrium by means of an l = 1 helical field (plasma ripple delta sub 1 approximately 1), produced by capacitor-driven windings, and a small admixture of l = 0 field (delta sub 0 approximately 0.1) produced by flux-shaping annular grooves in the compression coil. The theoretical parameters for the toroidal equilibrium are discussed, and curves of their values applicable to Scyllac are given. Aberration fields produced by the varying image currents of the l = 1 windings in the l = 0 grooved compression coil wall are discussed and their effects estimated. Author (NSA)

N71-27046# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

AMPLITUDE AND DAMPING OF PLASMA WAVE ECHOES

M. Guillemot, G. Matthieussent, J. Olivain, F. Perceval, and A. Quemeneur 1970 4 p refs Presented at the 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 31 Aug.–4 Sep. 1970

(CEA-CONF-1601; Conf-700817-18) Avail: AEC Depository Libraries

A theory taking into account diffusion in velocity space shows that a spatial plasma echo exhibits new features when either the second wave amplitude or the distance between the transmitters is increased. Good agreement is found between this theory and experiment. Author (NSA)

N71-27048# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

INFLUENCE OF TRAPPED PARTICLES ON THE DRIFT WAVES

A. Samain 1970 4 p refs Presented at the 4th European Conf. on Controlled Fusion on Plasma Phys., Rome, 31 Aug.–4 Sep. 1970

(CEA-CONF-1616; Conf-700817-22) Avail: AEC Depository Libraries

The stability of the drift modes of a collisionless magnetically confined plasma slab is considered when shear is present and the field intensity is modulated. In the absence of such a modulation, the drift modes are generally convective and strongly localized in the direction of the plasma confinement. The field modulation introduces a coupling between these localized convective modes. Under proper conditions, unstable eigenmodes consisting of a sequence of convective localized modes may exist throughout the plasma. NSA

N71-27093# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

PLASMA CONTAINMENT IN A CIRCULARIZED QUADRUPOLAR MAGNETIC WELL: DECA 2B

D. Launois, P. Lecoustey, M. Nicolas, and J. Tachon 1970 4 p refs Presented at the 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 31 Aug.–4 Sep. 1970

(CEA-CONF-1597; CONF-700817-18) Avail: AEC Depository Libraries

The focalization of magnetic lines out of a quadrupolar well reduces the wall-plasma interaction. Such a trap confines a 500-eV hydrogen plasma with an initial density of 10 to the 12th power/cu cm. The decay time is 400 microseconds. Author (NSA)

N71-27099# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Departement de la Physique du Plasma et de la Fusion Controlee.

DRIFT WAVES IN A COLLISIONLESS PLASMA

P. Blanc, P. Brossier, P. Deschamps, R. Gravier, R. Pellat et al 1970 4 p ref Presented at 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 31 Aug.–4 Sep. 1970

(CEA-CONF-1612; Conf-700817-4) Avail: AEC Depository Libraries

Pressure-gradient-driven drift waves were observed in a collisionless, low-density plasma, 5.40 meters long. Comparisons with the theoretical predictions show a reasonable agreement. Author (NSA)

N71-27100# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics and Fusion Research.

A SPECTROSCOPIC INVESTIGATION OF A ROTATING PLASMA

Bertil Wilner 1970 10 p ref

(Rept-70-51) Avail: NTIS

By analyzing the Doppler shifts of spectral lines from different kinds of atoms and ions in a rotating plasma device it has been possible to study the velocity profile and to determine the maximum rotational velocity. The measurements are made on the FI device in Stockholm, where an ExB discharge takes place in the magnetic field from a central main coil surrounded by two auxiliary Helmholtz coils. The observations are made along a single chord passing through the rotating plasma in the equatorial plane of the device. Lines from H, Cl, CII, CIII, SiI, SiII, SiIII and SiIV are studied and the spectra are recorded on a photographic plate. A time resolving unit makes it possible to choose the time of observation. The results support earlier theories. The maximum velocity is at least 1.3 x 100,000 m/sec. The hotter regions rotate at a larger velocity than the surrounding colder regions. Further the central parts of the plasma are screened from the surrounding neutral gas. Author (ESRO)

N71-27142# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

TWO ION COLLISIONAL ABSORPTION OF LOW FREQUENCY ELECTROMAGNETIC WAVES IN A TOROIDAL HARD CORE CONFIGURATION

J. Adam, F. Alvarez de Toledo, and D. Feltin 1970 4 p ref Presented at the 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 31 Aug.–4 Sep. 1970

(CEA-CONF-1614; CONF-700817-2) Avail: AEC Depository Libraries

The absorption of the fast hydromagnetic wave propagating in a two-species plasma (H + D) was investigated in a Levitron-type device. In agreement with the calculations, the wave could be excited for experimental parameters appropriate to the collisional absorption, and the damping length outside the emission coil was found to be minimum for omega sub cH less than omega less than omega sub cD. Author (NSA)

N71-27143# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Departement de la Physique du Plasma et de la Fusion Controlee.

CHANGE IN THE POLARIZATION OF AN ELECTROMAGNETIC WAVE IN A SHEARED MAGNETIC FIELD

R. Cano, C. Etievant, I. Fidone, and B. Zanfagna 1970 4 p ref Presented at 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 31 Aug.–4 Sep. 1970

(CEA-CONF-1608; Conf-700817-11) Avail: NTIS

The experiment described showed that an extraordinary electromagnetic wave propagating across a plasma column, confined by a slightly sheared magnetic field, is partially converted into an ordinary mode at the upper hybrid resonance. Author (NSA)

N71-27193# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

APPARATUS FOR I SUB c, H CHARACTERISTIC MEASUREMENTS ON HIGH CURRENT SUPERCONDUCTING SHORT SAMPLES [APPARATUR ZU HOCHSTROM I SUB c, H-MESSUNGEN AN KURZPROBEN SUPRALEITENDER MATERIALIEN]

W. Amenda Mar. 1970 31 p refs In GERMAN; ENGLISH summary

(IPP-4/71) Avail: AEC Depository Libraries

A setup is described which allows measurements on superconducting short samples in fields up to 52 kOe and currents up to 3500 A. The 52 kOe coil has a 50-mm bore (diameter) and 240-mm length. An axial length of 100 mm is available for the centered location of the sample. Besides the presentation of data describing the setup performance, the problem of the sample contacts is treated in detail, especially with regard to the heating influence of the environment on the sample. A description is given of the technique used, measurement process, and evaluation. Author (NSA)

N71-27200# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

VELOCITY DISTRIBUTION OF ANISOTROPIC DEUTERIUM PLASMAS FROM TIME RESOLVED NEUTRON SPECTRA [GESCHWINDIGKEITSVERTEILUNG ANISOTROPER DEUTERIUMPLASMEN AUS ZEITAUFGELOESTEN NEUTRONENSPEKTREN]

J. Neuhauser Jul. 1970 58 p refs In GERMAN; ENGLISH summary

(IPP-1/109) Avail: AEC Depository Libraries

The ion energy in hot deuterium plasmas can be determined by using the Doppler broadening of the d-d neutron line at 2.45 MeV. A method allowing time resolved measurement of neutron spectra in pulsed discharges is described. It utilizes the known energy dependence of the total neutron cross section of light to medium nuclei for energy selection of the neutrons. The method is applied to a theta pinch for investigating the anisotropy and relaxation of the deuteron velocity distribution. Suitable combination of the procedure with known diagnostic methods allows deviations of the velocity distribution from the isotropic Maxwell distribution to be determined with sufficient accuracy. Comparison of the experimental relaxation rate with the theoretically predicted collision relaxation shows that Coulomb collisions are not a sufficient explanation. The short-wave mirror instabilities also observed probably make a major contribution to the relaxation of the anistropic velocity distribution. Author (NSA)

N71-27203# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

HARMONIC ABSORPTION OF MICROWAVES IN MAGNETIZED LOW DENSITY PLASMA

R. Cano, I. Fidone, M. Schwartz, and B. Zanfagna 1970 4 p refs Presented at the 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 31 Aug.–4 Sep. 1970

(CEA-CONF-1607; CONF-700817-10) Avail: AEC Depository Libraries

Increased ionization and temperature due to harmonic cyclotron absorption were observed in a low-density, warm, magnetized plasma subjected to high-power microwaves. Author (NSA)

N71-27204# Commissariat a l'Energie Atomique, Limeil (France). Centre d'Etudes.

SPECTROSCOPIC MEASUREMENT OF THE ELECTRON TEMPERATURE OF A PLASMA IN THE VACUUM UV [MESURE DE LA TEMPERATURE ELECTRONIQUE D'UN PLASMA PAR SEPCTROSCOPIE DANS L'ULTRA-VIOLET SOUS VIDE]

A. Bernard, P. Genta, and A. Jolas [1970] 37 p refs In FRENCH

Avail: AEC Depository Libraries

The electronic temperature of a deuterium plasma was measured using vacuum spectroscopy. The Z pinch studied was a noncylindrical revolution type. The method consisted of measuring the rates of the intensities of two lines of an additional gas as a function of time. Two adjacent oxygen lines corresponding to the O 5 and O 6 ionization states were chosen; these wavelengths are particularly suitable for monochromator measurements. The characteristic plasma time was such that a quasi-equilibrium (corona type) was established. The theoretical value of the ratio between the intensities was calculated as a function of the electron temperature for electron densities of 10 to the 17th power/cc and 3 × 10 to the 17th power/cc. During a 1-microsec interval, the plasma temperature is almost constant at 16 eV. The experimental difficulties encountered are outlined. NSA

N71-27230# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

PLASMA EQUILIBRIA OF TOKAMAK TYPE, PART 1

H. P. Zehrfeld and B. J. Green Jun. 1970 19 p refs

(IPP-3/1-Pt-1) Avail: AEC Depository Libraries

A general formalism is given for the description of an axisymmetric plasma equilibrium. This is a model for the steady operation of a Tokamak device. The hydromagnetic equations taking into account effects such as tensorial resistivity and finite thermal conductivity are used. The reformulation of this set leads to an equivalent set that includes the generalization to toroidal geometry of the Bennett–Pinch relation, and an expression for the resistive plasma loss that shows explicitly the effect of the discharge current. This mathematically concise presentation of the full resistive equilibrium problem is appropriate to practical calculations. As an example, a steady state with no mass sources is considered for the case of small inverse aspect ratio. Author (NSA)

N71-27231# Rheinisch-Westfalische Technische Hochschule, Aachen (West Germany). Inst. fuer Physik.

PROBLEMS IN CALCULATING NUMERICALLY ARC HEATERS AND PLASMA PROPULSIONS [PROBLEME DER NUMERISCHEN MATHEMATIK BEI DER BERECHNUNG VON BOGENHEIZGERAETEN UND PLASMATRIEBWERKEN]

H. Druxes, A. Wynands, and U. Klein Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Feb. 1971 64 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.

(BMBW-FB-W-71-09) Avail: NTIS; ZLDI Munich: 17.70 DM

Interesting effects from a physical point of view are discussed for some different layouts of arcs (e.g. cylinder and torus geometry, inlet and outlet range of an arc) by means of numerical calculation results. Some model theories to solve analytically the given set of equations of the single-fluid model of plasma physics are summarized. In addition different numerical methods of solution are analyzed. Problems of uniqueness, of consistency, and of convergency especially for general relaxation methods are discussed and are illustrated by examples of the hydrodynamic behavior of a plasma configuration. The investigations made and the gained results present important indications and they are the basis for other numerical investigations of arc heaters and plasma jets of different geometries. Author (ESRO)

N71-27264# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

INVESTIGATION OF THE EROSION PHENOMENON IN HIGH CURRENT, HIGH PRESSURE GAS DISCHARGES

J. E. Gruber and R. Suess Dec. 1969 31 p refs

(IPP-4/72) Avail: AEC Depository Libraries

The erosion measured as the loss of electrode material was determined in different spark gaps with plane parallel electrodes. In the range from 50 to 300 kA and a corresponding total current conduction between 1 and 50 Coulomb per discharge, the erosion in a 1.5-mm gap was found to be nearly two orders of magnitude higher than in a 13-mm gap at atmospheric pressure. The close electrode spacing was found to be responsible for the increased erosion rather than the gas pressure. Erosion values for an oscillatory current are given for aluminum, brass, stainless steel, molybdenum, tungsten, and tungsten–copper alloys. Author (NSA)

N71-27276# General Electric Co., Philadelphia, Pa. Missile and Space Div.

SPLIT IMAGE LINE REVERSAL TECHNIQUE FOR SHOCK TEMPERATURE STUDIES

A. Guttman and E. Tate 20 Jul. 1970 37 p refs

(Contract N00014-70-C-0321)

(AD-721090; DOC-70SD288; ONR-TR-16) Avail: NTIS CSCL 20/9

A new experimental technique has been used to obtain line reversal temperature measurements behind reflected shocks in a cesium seeded MHD shock tube. Utilizing a compact single filament, split image arrangement, the apparatus is arranged in line and requires only one set of optics to accomodate both high and

low temperature channels. Results in the reflected shock region of a Mach 3 shock were obtained by means of the blue resonance line of the principle series of cesium (lambda 4555A). Temperatures were found to be a few percent lower than given by the Rankine-Hugoniot relations. The difference is attributed to the heat of vaporization of the cesium particles and subsequent ionization. Electron densities based on these temperature measurements were combined with simultaneous free-bound continum radiation measurements and reported recombination cross-sections to yield results consistent with equilibrium calculations. Author (GRA)

N71-27305# Naval Postgraduate School, Monterey, Calif.

A MATHEMATICAL MODEL OF THE BASIC ELECTRO-HYDRODYNAMIC PROCESS INCLUDING EFFECTS OF TURBULENCE

Theodore H. Gawain Dec. 1970 64 p refs

(AD-720703; NPS-57GN70121A) Avail: NTIS CSCL 20/9

A mathematical model of the basic electro-hydrodynamic (EHD) process is developed and described. The carrier fluid is treated as incompressible and turbulent. The injected particles are treated as uniform in mass and electrical charge. The analysis is broken down into three phases, namely, the basic flow, the perturbation due to injection of mass, and the perturbation due to introduction of electrical charge. This method greatly simplifies and improves the analysis. A final system of nine basic partial differential equations is obtained. These equations, along with the appropriate boundary conditions, fix the fluid and particle velocities and particle density at all points in the field. The basic equations are developed in a fully non-dimensional form. The mathematical model here presented is unique in its analytical approach and in its treatment of turbulence effects. Through computer simulation, it offers new possibilities for the study and development of EHD power generation systems. Author (GRA)

N71-27315# Avco Corp., Wilmington, Mass. Systems Div.

EFFECT OF A RADIALLY AND AZIMUTHALLY INHOMOGENEOUS PLASMA ON AN APERTURE IN AN INFINITE CONDUCTING CYLINDER

Ronald L. Fante 26 Feb. 1971 14 p refs

(Contract F19628-69-C-0121)

(AD-721204; AVSD-0143-71-CR; AFCRL-71-0147; SR-5) Avail: NTIS CSCL 20/9

The report considers a slot on an infinite cylinder which is covered by a plasma which is inhomogeneous in both the radial and azimuthal directions. Admittances are computed and compared with those for the case when the cylinder is covered by a plasma which is azimuthally homogeneous. Author (GRA)

N71-27316# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

INVESTIGATONS AT THE ION BEAM INJECTION SYSTEM ISIS 1 USING A DUOPLASMATRON WITH ELECTRON OSCILLATION IN THE ANODE PLASMA [MESSUNGEN AN DEM IONENSTRAHL INJEKTOR SYSTEM ISSIS 1 MIT PENDELELEKTRONEN DUOPLASMATRON]

Peter Ulbricht Apr. 1970 29 p refs In GERMAN; ENGLISH summary

(IPP-2/87) Avail: AEC Depository Libraries

Investigations were made to find suitable conditions for the injection of an ion beam that has small divergence, high intensity, and Gaussian density distribution. It is shown that the only parameters that influence the beam are those acting at the plasma boundary. These are the parameters of the ion source that determine the emission, and also the extraction field strength and the shape of the extraction field. A modified four-electrode duoplasmatron, with electron oscillation in the anode plasma, was used as an ion source to obtain a favorable relation between arc current and emission current. The space-charge forces of the plasma boundary could be decreased by means of a phasma expansion cup. Furthermore, the different influences of the deceleration-acceleration system on the beam were investigated. The mass analysis of the beam showed that this type of ion source delivers up to 50% H(+) ions for arc currents in the range 1 to 7 A. A high portion of metastable ions were observed. Author (NSA)

N71-27317# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

PRODUCTION AND CONFINEMENT OF ELECTRON CYCLOTRON RESONANCE PLASMAS IN THE W IIa STELLARATOR

R. A. Ellis, Jr. and D. Eckhartt Jul. 1970 33 p refs

(IPP-2/85) Avail: AEC Depository Libraries

Preliminary measurements of noble gas plasmas generated by low-power CW ECR were made in the stellarator. Densities were in the range 10 to the 8th power to 10 to the 10th power/cu cm and electron temperatures ranged from 4 to 11 eV. The general features of the density versus transform curves are quite similar to those observed with barium plasmas produced by contact ionization. The confinement time is estimated to be about 10 Bohm times. The discharges, in general, are turbulent and show fluctuations in the range expected for drift waves. Results are compared with those obtained in other stellarators. Author (NSA)

N71-27318# California Univ., Berkeley. Space Sciences Lab.

DOPPLER SHIFT IN FREQUENCY IN THE TRANSPORT OF ELECTROMAGNETIC WAVES THROUGH AN UNDERDENSE PLASMA

J. L. Peacher and K. M. Watson 1970 4 p ref Submitted for publication

(Contract DAHC04-67-C-0070)

(AD-721047; AROD-7456-8-P) Avail: NTIS CSCL 20/14

A transport equation for the intensity of electomagnetic radiation scattered by an underdense plasma has recently been derived by Watson. However, the Doppler shift in frequency due to the motion of the scattering electrons was neglected. This work extends the transport theory to include any frequency shift of the scattered waves. Author (GRA)

N71-27392# University of Southern Calif., Los Angeles. Dept. of Physics.

TEMPERATURE MEASUREMENTS OF AR PLASMA ARCS AND PRELIMINARY F+VALUE MEASUREMENTS OF LYMAN BETA, GAMMA AND DELTA

Shizuko Ogawa and G. L. Weissler Wright-Patterson AFB, Ohio ARL Dec. 1970 40 p refs

(Contract F33615-68-C-1228)

(AD-720856; USC-Vac-UV-122; ARL-70-0286) Avail: NTIS CSCL 20/9

A wall-stabilized arc is investigated spectroscopically in both the visible and the vacuum ultraviolet regions in the A. part of the report. The plasma temperature is studied as a function of pressure and deviations from the local thermal equilibrium (LTE) are observed. The B. part deals with preliminary measurements of f-values of the hydrogen resonance lines Lyman-beta, gamma, delta. Finally, it is shown that the arc can also be operated in helium. Author (GRA)

N71-27405 North Carolina State Univ., Raleigh.

ELECTRON AND ION SIGNAL PROPAGATION IN A QUIESCENT PLASMA

John Roberto Proni (Ph.D. Thesis) 1970 131 p

Avail: Univ. Microfilms Order No. 70-12833

Electron and ion pulse propagation in a plasma are discussed. Considered are the nature of the plasma formed interior to a helical electron beam and various transmitting and receiving antennas. The ion-acoustic pulse and the ion-ballistic pulse are studied. The ion-ballistic pulse is found to have a speed of propagation dependent

upon the amplitude of the applied voltage pulse. The ion-acoustic pulse speed of propagation is independent of the amplitude (within the voltage range 6 to 50 volts) of the applied voltage pulse. The ion-ballistic pulse is generated more easily when the transmitting antenna is negative (approximately −50 volts) with respect to the plasma. Multiple reflections of both types of ion pulses have been observed. Ion pulses launched by sinusoidal signals have likewise been observed. Dissert. Abstr.

N71-27419# United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF ENERGY TRANSFER PROCESSES IN MOLECULAR GAS DISCHARGES
Walter J. Wiegand, William L. Nighan, and Robert H. Sullis 31 Mar. 1971 44 p refs
(Contract F19628-70-C-0165)
(AD-720878; UACRL-K920938-4; AFCRL-71-0040) Avail: NTIS CSCL 20/9

The investigation was directed toward determining the energy transfer processes in nonequilibrium molecular gas discharges with and without easily ionizable seeding agents. Toward this end, electron energy distribution functions were calculated from the reported cross sections for momentum transfer, vibrational, electronic, and ionization processes in a He-N2 gas mixture. From these distribution functions the rates of energy transfer into the various vibrational and electronic channels were evaluated for a range of discharge conditions appropriate to glow discharge operation. In addition, electron transport properties were determined and estimates made of ion transport coefficients. The contribution due to the two-step ionization processes was also estimated. From these data the properties of the positive column of the discharge were evaluated. It has been found that generally good agreement between analytical and experimental results can be obtained if these important factors are accounted for in the analytical modeling of the discharge. In addition, the potential effects of an alkali seed on the ionization processes in the He-N2 discharge are discussed. The study of a cesium seeded-molecular discharge represents the next phase of this analytical and experimental investigation. Author (GRA)

N71-27692# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PRODUCTION OF ION STREAM COMPOSED OF TWO COMPONENTS IN VELOCITY DISTRIBUTION
Tadao Honzawa Sep. 1970 13 p refs
(IPPJ-97) Avail: AEC Depository Libraries

A new type source of ion stream composed of two components in energy distribution is investigated. A diffusion type plasma source is used, which is formed with two arrays of oxide coated cathode rods and five sheets of metallic mesh grids. The energy distribution of ion stream is observed with an electrostatic energy analyzer, whose resolution is 4%. Ion streams of argon, helium, nitrogen and their mixtures are obtained, the energy of which ranges from 50 to 500 eV. The energies of two components of ion stream are determined by the biases externally applied to two pairs of grids, and their relative intensities can be controlled by adjusting the temperature of the fore array of cathode rods and/or the potential of the intermediate grid. Author (NSA)

N71-27694# Ohio State Univ., Columbus. Dept. of Physics.
ROTATING R-FIELD PLASMA FOR THERMONUCLEAR POWER REACTORS Final Report, 1 Mar. 1969 – 31 Oct. 1970
Marion L. Pool Feb. 1971 10 p
(Grant AF-AFOSR-1713-69)
(AD-720847; AFOSR-TR-71-0730) Avail: NTIS CSCL 20/9

A hydrogen plasma was created in a magnetic bottle by the use of a two-phase oscillator operated at a cyclotron frequency of 4.225 MHz. Ion densities and energies in the neighborhood of 5 x 10 to the (-12) power/cc and 400 eV were achieved. A disc-type dense plasma focus device of 8-3/4 inch diameter operated best at a deuterium pressure of 0.7 Torr. Ion densities and energies in the neighborhood 10 to the 19th power/cc and 100 eV were achieved. Author (GRA)

N71-27695# Army Electronics Command, Fort Monmouth, N.J.
VISCOUS EFFECTS ON THE RAYLEIGH-TAYLOR INSTABILITY
Leonard M. Compton Feb. 1971 52 p refs
(AD-720995; ECOM-3392) Avail: NTIS CSCL 20/9

The gravitational instabilities of a system consisting of two homogeneous fluids in a concentric cylindrical configuration (theta-pinch), in the presence of a uniform axial magnetic field, are investigated. The fluids are assumed to be incompressible, and viscous, with infinite conductivity. The dispersion relation is developed by two methods. In the first, an exact determination is made based upon the time development of an infinitesimal disturbance of the equilibrium conditions. In the second, it is shown that it is possible to use a variational calculation regardless of whether the system is self-adjoint. Author (GRA)

N71-27696# Avco-Everett Research Lab., Everett, Mass.
MOMENTUM TRANSFER IN PLASMA FLOWS AT HIGH ALFVEN MACH NUMBERS
Herbert W. Friedman and Richard M. Patrick Feb. 1971 67 p refs
(Contract DASA01-67-C-0131)
(AD-720335; AERL-RR-355) Avail: NTIS CSCL 20/9

Momentum coupling between two interpenetrating plasmas in the presence of a weak magnetic field has been studied experimentally. A coaxial plasma gun ionizes and accelerates ionized aluminum into a low pressure background gas which has been preionized by ultraviolet radiation from the gun. A steady magnetic field is applied parallel to the aluminum flow with maximum amplitude such that the ratio of dynamic aluminum pressure to magnetic pressure is of order 1000, the ion gyro radius is much larger than overall flow scale, and the Alfven Mach number is greater than 10. Under these conditions, the field should have no direct influence on the deceleration rate of the aluminum plasma. Streak camera photographs show little momentum transfer between the two plasmas when no field is applied, verifying collisionless conditions and almost complete transfer when field is applied. Magnetic field probes show that the applied field has been pushed aside by the aluminum plasma creating a field free bubble region. The scale length of the electron density gradients has been measured with a holographic interferometer indicating momentum transfer lengths less than 1 cm and thus two orders of magnetic less than the ion gyro radius. Author (GRA)

N71-27697# Perks Mathematical Labs., Inc., Carlisle, Mass.
MATHEMATICAL SUPPORT STUDY OF MAGNETOIONIC THEORY Final Report, Jul. 1968 – Dec. 1970
Lorenzo Celsbi Jan. 1971 21 p
(Contract F19628-68-C-0006)
(AD-720879; AFCRL-71-0055) Avail: NTIS CSCL 20/9

The report discusses the following areas of research under the contract: Collaborative study of mathematical models of shock-waves problems; Numerical analysis of shock-waves and propagating waves; and, Numerical analysis of the nonlinear dispersion equation, with various distributions. GRA

N71-27699# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
BASIC COLLISION PROCESSES IN PLASMAS; COLLISION CROSS SECTIONS, LECTURE 1
H. W. Darwin 1970 39 p refs Presented at 5th Plasma Phys. Symp. and Summer School, Herceg-Novi, Yugoslavia, 6 – 16 Jul. 1970
(CEA-CONF-1627; Conf-700706-1) Avail: AEC Depository Libraries

In plasmas, molecules and molecular ions have translational,

rotational, vibrational, electronic, and chemical energy; atoms and atomic ions have translational, electronic, and chemical energy, and electrons have only translational energy. Collisions between these particles lead to energy transfers between these different types of energies, and a table, which has the form of a matrix, gives a simple classification of these interaction processes. The rules and regularities in collision processes are recalled and the general behavior of some selected cross sections is reviewed. NSA

N71-27600 California Univ., San Diego.
ON SOME NONLINEAR PROBLEMS IN THE MANY-BODY THEORY OF TURBULENT PLASMAS
Jide Ogunsna (Ph.D. Thesis) 1969 214 p
Avail: Univ. Microfilms Order No. 70-11949

The problem of turbulent many body systems is formulated in terms of a generalized phase space, using the concepts of field theory. Utilizing this notion, a stochastic theory approach is used to formulate the problem of plasma heating by random fields. Application of the theory to stochastic acceleration of a magnetized plasma yields a heating rate which asymptotically approaches that of Puri. A new nonlinear method is presented for obtaining the single particle distribution function. Applications to ionospheric physics and thermonuclear fusion are discussed and a procedure for investigating the nonlinear resonant wave-wave interaction in Vlasov plasmas is obtained. Dissert. Abstr.

N71-27624# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
SPECTROSCOPIC DIAGNOSTICS OF NONEQUILIBRIUM PLASMAS
H. W. Drawin 1970 55 p refs Presented at the 5th Plasma Phys. Symp. and Summer School, Herceg-Novi, Yugoslavia, 6-16 Jul. 1970
(CEA-CONF-1628; Conf-700706-2) Avail: AEC Depository Libraries

The spectroscopic diagnostics of plasmas not locally in thermodynamic equilibrium are based upon certain fundamental equations that give a spectroscopic description of the plasma. A collision equation was established that could be applied to any type of particle in a continuous or a discrete energy state. In order to effect a plasma diagnostic, the measurable quantities must be associated with the fundamental quantities appearing in the collision equations. Relations describing changes in population density, momentum, and energy were established for each type of particle by using a radiative collision model. The results obtained on the intensities of the spectral lines arising from plasmas and Thomson and Rayleigh scattering are briefly reviewed. NSA

N71-27625# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
ION HEATING BY BEAM PLASMA INTERACTION
F. Bottiglioni 1970 4 p refs Presented at 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 31 Aug.-4 Sep. 1970
(CEA-CONF-1611; Conf-700817-5) Avail: AEC Depository Libraries

A powerful electron beam was injected longitudinally in a magnetic mirror configuration. By ionization of the H2 gas, a plasma was produced that was heated by interacting with the beam itself. The hot plasma density and the ion temperature were, respectively, a few 10 to the 11th power cm/-3 and a few hundred eV. Author (NSA)

N71-27737# United Kingdom Atomic Energy Authority, Culham (England).
MEASUREMENT OF THE PLASMA PARAMETERS IN TOKAMAK T2-A BY THOMSON SCATTERING
M. J. Forrest, N. J. Peacock, D. C. Robinson, V. V. Sannikov, and P. D. Wilcock 1970 42 p refs
(CLM-R-107) Avail: AEC Depository Libraries; HMSO 7si BIS $1.50

The electron temperature and density in Tokamak T3-A are established from an analysis of the spectral intensity of the scattered photons from a pulsed ruby laser. Electron temperatures up to 2 keV are measured over a range of densities and ohmic heating currents. Radial measurements show the pressure profile to be practically flat over the central half of the plasma. The total energy in the plasma column agrees with that measured from the diamagnetic signal. It is shown by considering the energy balance, taking into account the anomalous factor in the heating, that the main energy loss is by heat conduction, which is anomalously large for all but the highest densities. Author (NSA)

N71-27839# TRW Systems Group, Redondo Beach, Calif.
MAGNETIC FIELD ANNIHILATION OF PLASMA FOR ADVANCED PLASMA ENGINE DESIGN Final Report
C. L. Dailey 31 Mar. 1971 36 p refs
(Contract F44620-70-C-0035)
(AD-721214; TRW-14649-6001-RO-00; AFOSR-TR-71-0328)
Avail: NTIS CSCL 20/9

The ejection of energetic streams of plasma from the sun during solar flares indicates the action of a powerful acceleration process. This mechanism has been explained in terms of the rapid release of magnetic field energy resulting from the collision of streams of plasma carrying oppositely directed magnetic fields. In such a collison the field is annihilated and the corresponding energy is converted to kinetic energy of the ejected plasma. A two-coil pulsed inductive machine has been built at TRW Systems which makes use of this process to accelerate and heat a plasma. In one region of thg machine the solar flare process is produced and the energy released by magnetic field annihilation is converted to kinetic energy. The information obtained from experiments in this region of the machine can be applied to the design of a high performance pulsed plasma thruster. In a different region of the device the magnetic field energy is converted to ion heating and compression. The application of the field annihilation mechanism may be useful for controlled thermonuclear fusion. This report describes the two-coil accelerator and reviews the background upon which the experimental investigation is based. Construction of the machine is finished and testing of the control circuitry is proceeding. Author (GRA)

N71-27840# Commissariat a l'Energie Atomique, Limeil-Brevannes (France). Centre d'Etudes.
THOMSON SCATTERING IN LASER CREATED PLASMA [DIFFUSION THOMSON DANS UN PLASMA CREE PAR LASER]
Michel Decroisette Sep. 1970 22 p In FRENCH
(CEA-R-4058) Avail: AEC Depository Libraries

The scattered spectrum of monochromatic radiation incident from a laser created plasma is computed, using the Salpeter theory and taking into account the inhomogeneity of the plasma. The FORTRAN program is used to calculate the average parameters of the plasma from a given profile. The shape of the complex spectrum is shown to be generally associated with the most dense zone, which is also the hottest. Author (NSA)

N71-27887# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ION ACOUSTIC WAVE INSTABILITY AT VLF IN THE POLAR WIND Research Report, Nov. 1969-Jul. 1970
Harry C. Koons, Donald A. McPherson, and Michael Schulz 30 Nov. 1970 47 p refs
(Contract F04701-70-C-0059)
(AD-720243; TR-0059(9220-02)-3; SAMSO-TR-70-437) Avail: NTIS CSCL 4/1

Calculations based on plasma kinetic theory reveal that ion-acoustic waves in the ELF and VLF frequency bands become unstable in the polar wind when the relative flow velocity between the hydrogen ions and oxygen ions enters the range 5-10 km/sec. Either of two distinct roots of the dispersion equation can exhibit

growth, depending upon the relative composition of the plasma and the relative flow velocity. Electrostatic waves in the appropriate frequency range have been observed at altitudes 2500-4500 km over the polar regions by a VLF receiver on the OV3-3 satellite. These waves may be important in impeding the escape of polar-wind hydrogen and helium ions. Author (GRA)

N71-27888# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
LASER ENERGY NECESSARY FOR INERTIALLY CONFINED NUCLEAR FUSION PLASMA
H. Hora and D. Pfirsch Oct. 1970 8 p refs
(IPP-4/7; IPP-6/91) Avail: AEC Depository Libraries

The gain G of the thermonuclear fusion energy of very dense spherical plasmas heated by lasers in times of about 1 nsec is treated theoretically. Assuming as a pessimistic estimate that fast ions leave the plasma without contributing to fusion neutrons, one finds that for G = 1, laser energies of 3 x 10 to the 7th power joules are needed. A kinetic theory for a one-species gas, starting with a gaussian density and velocity profile, yields almost the same result as found by a hydrodynamic model with adiabatic expansion and without fast-ion losses taken into account. Therefore, the even point of G = 1 is reached at the well-known value for the laser energy of 4.6 x 10 to the 6th power joules for a D-T reaction. Author (NSA)

N71-27889*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLUTION SCHEME FOR TIME DEPENDENT HYDRODYNAMIC PLASMA FLOW ALONG A MAGNETIC FIELD LINE
J. M. Grebowsky and R. K. Smith (Md. Univ., College Park) Apr. 1971 36 p refs Submitted for publication
(NASA-TM-X-65554; X-621-71-173) Avail: NTIS CSCL 20I

A mathematical procedure, using the method of characteristics, is developed for solving the hydrodynamic flow equations in a nonhomogeneous magnetic field for plasma flow along a field line in the presence of a gravitational field. Along a dipole magnetic field line with two supersonic plasma streams symmetrically directed towards the magnetic equator (a situation applicable to the earth's environment) the solution is obtained by assuming the existence of shock discontinuities which propagate along the field line. The solution technique for the time development of the plasma flow is considered for both adiabatic and isothermal flow. A sample calculation for an adiabatic flow state shows explicitly the time evolution of adiabatic cooling and shock heating along a magnetic field line. Author

N71-27890*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THEORY OF THOMSON SCATTERING FROM A WEAKLY IONIZED PLASMA
Richard G. Seasholtz Washington Jun. 1971 48 p refs
(NASA-TN-D-6372; E-6051) Avail: NTIS CSCL 20I

The theory of Thomson scattering from a weakly ionized plasma is extended to include the effects of unequal electron and ion temperatures, a constant magnetic field, and electron drift. The plasma is described by the two fluid continuum equations that are valid if the wavelength of the probing wave is longer than the ion-neutral mean free path. The spectrum and total scattered power are calculated. Collisions and a magnetic field are both shown to influence the scattered power for unequal electron and ion temperatures. Author

N71-27891# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
HYDROMAGNETIC EQUATIONS FOR ANISTROPIC PLASMAS INCLUDING TRANSPORT EFFECTS
R. Chodura and F. Pohl Sep. 1970 37 p refs
(IPP-1/112) Avail: AEC Depository Libraries

A set of hydrodynamic equations is derived for an arbitrary anisotropic plasma, allowing for Coulomb collisions among plasma particles. Using a generalized expansion in Hermite polynomials for the distribution functions of plasma constituents the collision integrals occurring in the hydrodynamic equations are calculated. Explicit results for the coefficients of ion viscosity and heat conductivity of ions and electrons are derived. Author (NSA)

N71-27916# Centralny Instytut Informacji Naukowo-Technicznej i Ekonomicznej, Warsaw (Poland).
NUKLEONIKA, VOLUME 14, NO. 11
[1969] 134 p refs Transl. into ENGLISH from Nukleonika (Warsaw), v. 14, no. 11, 1969 p 1037-1184 Supported by AEC and NSF
(AEC-tr-7027/11; TT-69-50012/11) Avail: NTIS

The axial speeds of different groups of ions were measured in a rod plasma injector using a monochromator. These measurements showed that the velocities of different groups of ions are practically equal. The average velocity of the ions was about 5.5 x 1 million cm/sec for a delay time of gas supply tau = 60 milliseconds, and 3.5 x 1 million cm/sec for tau = 240 milliseconds. It was also found that all the groups of ions are mixed in a plasmoid and no ordered pattern, concerning the distribution of ions in the plasmoid exists. The speed of the plasmoid was also estimated with the aid of ultrafast photography. A reasonably good agreement was observed between the velocities of ions and those of plasmoids. The results obtained are discussed and an attempt is made to find a suitable explanation. Author (NSA)

N71-27917# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany).
INFLUENCE OF ELECTRICAL CONDUCTIVITY ON THE EQUILIBRIUM OF LOW PRESSURE PLASMA IN STELLARATORS [DER EINFLUSS DER ELEKTRISCHEN LEITFAEHIGKEIT AUF DAS GLEICHGEWICHTSVERHALTEN VON PLASMEN NIEDRIGEN DRUCKS IN STELLERATOREN]
D. Pfirsch and A. Schlueter [1970] 14 p refs In GERMAN
(MPI/PA-7/62) Avail: AEC Depository Libraries

In finite electric conductivity plasma there is no static, but only stationary, equilibrium in stellarators. The currents arising in such configurations, the related diffusion, and the electric fields were calculated by means of a simple model. The duration of the acceleration process up to the attainment of the current velocities was estimated. The general results are that the diffusion is larger than the normal diffusion and that, in plasmas of high density and low temperature, the duration of the acceleration process can be so great that the plasma drifts to the wall before attainment of the equilibrium state. Author (NSA)

N71-27918# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Technische Physik.
APPLIED MAGNETOHYDRODYNAMICS. ISSUE 6: PARAMETRIC STUDIES AND DIMENSIONING OF NOBLE GAS MHD GENERATORS [ANGEWANDTE MAGNETOHYDRODYNAMIK. HEFT 6: PARAMETRISCHE STUDIEN UND DIMENSIONIERUNG VON EDELGAS-MHD-GENERATOREN]
Th. Bohn, Chr. Holzapfel, and G. Kolb Oct. 1970 41 p refs In GERMAN; ENGLISH summary
(JUL-706-TP) Avail: AEC Depository Libraries

Several parameters in connection with the total plant loop were considered in designing a MHD Generator for a nuclear MHD power plant. Thus, a limitation was established for the parameters in which it is possible to build the MHD generator without conflicting with the conditions of the other components of the power plant. The two working gases, argon and helium seeded with cesium, were numerically investigated, using a one dimensional

theory. Considering friction losses, the upper limit was calculated for the pressure at which it is possible to gain enough power as a function of Mach number. Several examples of the calculated parameters in the generator are shown. Author (NSA)

N71-27919# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

PLASMA CONFINEMENT IN THE Wlla-STELLARATOR: A COMPARISON BETWEEN EXPERIMENTAL RESULTS AND THEORETICAL ESTIMATES OF NEOCLASSICAL DIFFUSION

D. Eckhartt Jul. 1970 38 p refs

(IPP-2/86) Avail: AEC Depository Libraries

Experiments with plasmas generated by contact ionization, photoionization, and electron cyclotron resonance heating in the stellarator Wlla are reviewed. The magnitude of cross field particle diffusion observed in these experiments is compared with theoretical estimates of neoclassical diffusion. The scaling of these estimates from presently available plasma densities and temperatures towards higher temperatures predicts an increase in the diffusion rate, in contrast to what is expected from hydromagnetic theory. Author (NSA)

N71-27920# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

BOUNCE EFFECTS IN THE NEGATIVE MASS INSTABILITY

D. Launois, G. Laval, R. Pellat, and J. Tachon 1970 4 p refs Presented at the 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 31 Aug.–4 Sep. 1970

(CEA-CONF-1598; CONF-700817-19) Avail: AEC Depository Libraries

Unstable modes at bounce harmonics of the ion cyclotron frequency exist for any density. Thermal spreading reduces slightly the unstable domain. The decreasing of ion bounce frequency does not stabilize a dilute plasma. Author (NSA)

N71-27921# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

STRAIGHT STELLARATORS WITH STRONG HELICAL CURRENTS

E. K. Maschke Oct. 1970 38 p refs

(EUR-CEA-FC-543) Avail: AEC Depository Libraries

A type of toroidal stellarator configurations, called Torsatron, is produced by helical windings with all currents circulating in the same direction around the torus. Straight stellarator and Torsatron configurations are studied for large ratios of helical current to B sub Z coil current, and the limiting case of the Torsatron without B sub Z coils is investigated. Author (NSA)

N71-27927# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.

INVESTIGATIONS OF IONIC SPECIES IN HIGH PRESSURE CESIUM DISCHARGES Annual Report, 1 Mar. 1970–28 Feb. 1971

Lorne M. Chanin 28 Feb. 1971 45 p refs

(Contract N00014-67-A-0113-002)

(AD-720713; AR-5) Avail: NTIS CSCL 20/9

Ion sampling measurements were made on cesium plasmas for normalized pressures from .0001 to 1 Torr using dc as well as rf excitation. For dc discharges, sampling was undertaken through both the anode and cathode. The major cesium ions observed were Cs(+), Cs2(+), and Cs3(+). Measurements were made of the ion current ratios, I(Cs2(+))/I(Cs(+)), and I(Cs3(+))/I(Cs2(+)) as a function of normalized pressure. Comparison of the observed dependencies with those predicted using steady state-kinetics provides estimates of the rate coefficients. Author (GRA)

N71-27938# Eidgenossische Technische Hochschule, Zurich (Switzerland).

HELICON RESONANCES IN LOW-PRESSURE PLASMAS [HELIKONRESONANZEN IN NIEDERDRUCKPLASMEN]

Otto Seger 1970 117 p refs In GERMAN

(NP-18554) Avail: AEC Depository Libraries

A phenomenon in low-pressure discharges similar to what is known in solid-state plasmas as helicon resonances is investigated. Theoretical considerations based on a two-dimensional plasma sheet are extended by taking into account the influence of the electron temperature and the nonuniform density distribution. Experimental results obtained in rectangular and circular confinements of a high-frequency discharge with applied external static crossed magnetic fields agree with the improved theory. Measurements on surface-ionized Cs plasmas show that the resonance behavior is not significantly influenced by the plasma generation. The general behavior of the electrodeless ring discharge can be described by calculating the power per unit area transferred to the plasma by the right- and left-handed circularly polarized waves. The numerical results compare favorably with measurements, especially in the case of applied constant current and constant voltage of the hf generator. Author (NSA)

N71-27956# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

A TWO DIMENSIONAL COMPUTER PROGRAMME FOR SOLVING THE MHD EQUATIONS FOR THE THETA PINCH IN A TIME DEPENDENT COORDINATE SYSTEM

F. Hertweck and W. Schneider Jul. 1970 66 p refs

(IPP-6/90; IPP-1/110) Avail: AEC Depository Libraries

The axial losses of mass and energy at the ends of a theta pinch are investigated. The plasma is described by a one fluid model with the following assumptions: infinite electric conductivity, electron temperature equal to ion temperature, isotropic pressure, and radial equilibrium. The mechanism by which the disturbance due to mass and energy losses at the end of the theta pinch propagates into the inner part of the vessel is investigated. The relative importance of kinetic energy, heat conduction, and convection for the end losses is calculated. Author (NSA)

N71-27985# Commissariat a l'Energie Atomique, Limeil (France).

LASER-MATTER INTERACTION: STIMULATED AND NONLINEAR EFFECTS [INTERACTION LASER-MATIERE: EFFETS STIMULES ET EFFETS NON LINEAIRES]

Pierre Guillaneux [1970] 17 p refs In FRENCH

(CEA-N-1399) Avail: AEC Depository Libraries

High flux laser-plasma interaction is studied. The various effects produced are listed: nonlinear or stimulated Compton scattering, nonlinear bremsstrahlung, and electron-positron pair creation. Possible effects of these phenomena on energy changes in the plasma particles are considered. Author (NSA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N71-28817# Boston Coll., Chestnut Hill, Mass. Dept. of Physics.

INVESTIGATION OF ORGANIC SEMICONDUCTOR FOR PHOTOVOLTAIC APPLICATION Final Report, 1 Jul.–31 Oct. 1970

P. H. Fang, Mitsuji Hirata, and Masuko Hirata 10 Dec. 1970 44 p refs

(Contract F19628-70-C-0263)

(AD-721188; AFCRL-71-0056) Avail: NTIS CSCL 20/12

The photovoltaic effect and related processes in tetracene

have been investigated. Experiments were made to measure the following: (1) photovoltaic i-v curve, the efficiency of tetracene is found to be about 0.0000007, (2) the polarization and the hysteresis due to an application of external field are observed, (3) the decay of the polarization takes in the order of seconds to minutes, and (4) the spectral dependence of the photovoltaic current, especially the anomalous behavior of the polarity reversal of the current. Theoretical work was to study the kinetics of decay of the charges and the polarization, and the polarity reversal of the photovoltaic current. This work implies the experimental observations are quite universal among organic semiconductors, and are not confined to tetracene. Author (GRA)

N71-26908*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WIDE RANGE NUCLEAR MAGNETIC RESONANCE DETECTOR USING INTEGRATED CIRCUITS
John C. Sturman and Russell J. Jirberg Washington May 1971 26 p refs
(NASA-TN-D-6338; E-6033) Avail: NTIS CSCL 20L

The electronics developed for sensing nuclear magnetic resonance over a wide range of magnetic fields (0.1 to 18 T) are described. The system was designed to operate with a long coaxial transmission line between the RF coil and the electronics package, a feature which makes it suitable for use with high field cryomagnets. The instrument is small and portable, and it is constructed predominantly with commercially available integrated circuits. A computer program for the computation of the resonant modes of the coaxial lines is included. Author

N71-26996# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
CRYSTALLOGRAPHIC TECHNIQUES AND DATA FOR TRANSMISSION ELECTRON MICROSCOPY OF ZIRCONIUM
A. Jostsons and J. G. Napier Feb. 1970 47 p refs
(AAEC/E-204) Avail: AEC Depository Libraries

The crystallography of hexagonal close packed metals is discussed briefly in terms of the four-axis hexagonal basis and the Miller–Bravais notation. Electron diffraction problems are treated with reference to the four-axis hexagonal reciprocal lattice rather than the more usual three-axis hexagonal system. Using these concepts, analysis of electron-diffraction spot and Kikuchi patterns is illustrated and applied to orientation and dislocation Burgers vector determinations. Computed values of interplanar spacings, interplanar angles, angles between directions, and extinction distances for zirconium are listed. Author (NSA)

N71-27052# Iowa State Univ. of Science and Technology, Ames.
A STUDY OF THE FERMI SURFACES OF ANTIFERROMAGNETIC CHROMIUM-RICH ALLOYS USING THE DE HAAS-VAN ALPHEN EFFECT
Edward Joseph Gutman (Ph.D. Thesis) Nov. 1970 91 p refs
(Contract W-7405-eng-82)
(IS-T-420) Avail: NTIS

The dHvA measurements were made on chromium alloys with concentrations up to 2.0% V and 0.91 % Mn. It was assumed that the only effect of alloying small concentrations of V and Mn with Cr was to change the magnitude of the wave vector but not the size of the hole ellipsoids at N. The frequencies of interest were due to areas which result from three different truncations of the hole ellipsoids by the magnetic superlattice. Using the band structure calculations for commensurate antiferromagnetism in Cr, the dHvA signals in a 0.91% Mn crystal can be interpreted as being associated with the hole ellipsoids at M and the electron pieces at X in a simple cubic Brillouin zone. Other signals can be interpreted as due to the remnant of the hole octahedron after destruction by the antiferromagnetic interaction. The data for the Mn crystal and a self-consistent argument for the V data show that the rigid band model does not apply to the hole ellipsoid pieces of the Fermi surface of Cr. Two dimensions for the hole ellipsoids in the Mn sample are larger, and two dimensions for the V crystal are probably smaller than the corresponding dimensions in pure Cr. Author

N71-27237# Iowa State Univ. of Science and Technology, Ames.
SURFACE MODES OF VIBRATION AND OPTICAL PROPERTIES OF AN IONIC CRYSTAL SLAB
William Edward Jones (Ph.D. Thesis, Nov. 1970) Feb. 1971 108 p refs
(Contract W-7405-eng-82)
(IS-T-427) Avail: NTIS

A formalism is developed for calculating the normal modes of vibration of an ionic crystal slab having the NaCl structure. The slab consists of a finite number of (100) planes oriented normal to the z - axis and is of infinite extent in the x and y directions. The derivation of the dynamical matrix takes into account the free surfaces of the slab as well as the effect of retardation of the Coulomb interaction. The unretarded normal mode frequencies and eigenvectors are calculated for a 7 layer slab for values of the wave vector chosen along the x - axis and ranging from zero out to the boundary of the two-dimensional first Brillouin zone. If an electromagnetic wave is incident upon the slab, the optical properties of the slab can be found by calculating the total electric field which exists in the regions of space on either side of the slab as a superposition of the incident field and the induced field arising from the ionic motion within the slab. For both P and S polarization of the incident field peaks in the infrared absorption are found to occur at frequencies corresponding to certain optical modes of the slab. Author

N71-27250# Iowa State Univ. of Science and Technology, Ames.
GROWTH OF ZINC SINGLE CRYSTALS AT A CONTROLLED RATE FROM THE MELT
Robert John Wienert (M.S. Thesis) Feb. 1971 36 p refs
(Contract W-7405-eng-82)
(IS-T-441) Avail: NTIS

The equipment and procedures for controlled rate growth of zinc single crystals by the Bridgeman technique are described. Crystals 1.0 inch in diameter and 8.5 inches long were grown under different conditions of temperature gradient, growth rate, and radial heat loss. It was observed that two variables, growth rate and radial heat loss, had to be controlled to assure a high probability of single crystal growth. Sparkcutting to obtain the necessary surfaces for determination of crystal perfection was unsatisfactory and appeared to cause nucleation of a large number of dislocations. Author

N71-27263# Centre National de la Recherche Scientifique, Grenoble (France).
COLINEAR AND NONCOLINEAR MAGNETIC STRUCTURES IN THE RARE EARTH COMPOUNDS RNI3 AND R2NI7 [STRUCTURES MAGNETIQUES COLINEAIRES ET NON COLINEAIRES DANS LES COMPOSES DE FORMULES TNI3 ET T2NI7]
D. Paccard, J. Schweizer (Commissariat a l'Energie Atomique, Grenoble), and J. Yakinthos (Commissariat a l'Energie Atomique, Grenoble) 1970 6 p refs In FRENCH; ENGLISH Summary Presented at the Intern. Conf. on Magnetism, Grenoble, France, 14 - 19 Sep. 1970
(CEA-CONF-1704; CONF-700940-3) Avail: AEC Depository Libraries

The crystalline structures of the compounds RNi3 and R2Ni7 (R = rare earth element) can be represented by a superposition of hexagonal RNi5 cells with ordered substitutions of atoms. These substitutions lead to a hexagonal site and a pseudocubic site for the rare earth atoms. Two spin arrangements (colinear and canted) are possible due to the strong anisotropy of the rare earth in both crystallographic sites. A colinear structure was found to exist for

HONi3 and canted structures for Er2 and ErNi7. In these compounds, the nickel moment is almost zero and exchange interactions between rare earth atoms are small. In erbium compounds, local anisotropy favors different moment directions in both sites. In isomorphous compounds with cobalt, exchange interactions are enhanced by the magnetic moment of the cobalt and stabilize the colinear structure. A strong magnetic field can induce the change from a colinear to a canted structure with ErCo3.
Author (NSA)

N71-27277# Cornell Univ., Ithaca, N.Y. Dept. of Chemistry.
NEW NONSTOICHIOMETRIC COMPOUNDS WITH SEMICONDUCTOR-METAL TRANSITION Final Report
M. J. Sienko 31 Dec. 1970 13 p
(Grant AF-AFOSR-1726-69)
(AD-720888; AFOSR-70-2930TR) Avail: NTIS CSCL 20/12

The report summarizes research undertaken to synthesize and investigate new nonstoichiometric compounds of the transition elements, particularly at the metal-nonmetal transition. Systems studied included the oxide bronzes, oxygen-deficient oxides, and rare-earth hexaborides. Magnetic, electric, Hall and Seebeck, and resonance properties are described. The principal findings were that defects leading to nonstoichiometry are ordered at much lower dilutions than hitherto believed, the nonmetal-metal transition is rarely sharp, the magnetic coupling in the metallic state is quite weak.
Author (GRA)

N71-27278# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
FEMTOVOLT MEASUREMENTS OF THE SUPERCONDUCTING TRANSITION IN TIN WHISKER CRYSTALS
Ronald S. Newbower Jan. 1971 227 p refs
(Contracts N00014-67-A-0298-0022; ARPA SD-88; N00014-67-A-0298-0031; N00014-67-A-0298-0006; Grant NSF GP-11392)
(AD-721102; TR-4) Avail: NTIS CSCL 20/12

The onset of the resistive transition of one-dimensional superconductors has been studied with as much as 10 to the -15th power volt sensitivity, at currents as low as 0.000 000 1 ampere. The behavior in this region is determined by thermodynamic fluctuations of the order parameter. Measurements at 0.000 0002A on pure tin, single-crystal whiskers approximately one-half micron in diameter, agree over five decades of resistance change with the explicit predictions of the McCumber-Halperin modification of the Langer-Ambegaokar theory. Extensive development of the technology of Josephson-junction superconducting voltmeters was undertaken in the course of this experiment. A detailed analysis of the practical and fundamental bandwidth and sensitivity limitations of these techniques is given.
Author (GRA)

N71-27314 Missouri Univ., Rolla.
MOSSBAUER EFFECT STUDIES OF FERROELECTRIC PHASE TRANSITIONS IN THE PbZr03-PbTiO3-BiFeO3 TERNARY SYSTEM
James Philip Canner (Ph.D. Thesis) 1969 180 p
Avail: Univ. Microfilm Order No. 70-11762

The Mossbauer effect was used to measure the phase transitions in the following ferroelectric compounds: 95% PbZr(0.8)Ti(0.2)O3-5% BiFeO3 and 95% PbZr(0.7)Ti(0.3)O3-5% BiFeO3, and in the antiferroelectric compound: 95% PbZr03-5% BiFeO3. The parameters obtained were the area under the resonance peak, the isomer shift, and the electric quadrupole splitting, all as a function temperature. The ionicity, electric field gradient, and Debye temperature were determined for room temperature. The data are discussed in terms of the lattice vibration model of ferroelectrics and antiferroelectrics, and the structural phase transitions as recently defined for these compounds. The ionicity is determined and discussed in relation to crystal distortion and Curie temperature. The electric field gradient is related to the relative polarizations of the different samples. A discussion of the mixture of charge states in the A and the B ion sites of the perovskite structure, and the oxygen defect problem in these compounds, completes the discussion.
Dissert. Abstr.

N71-27402# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE SYNTHESIS OF EPITAXIAL GALLIUM ARSENIDE LAYERS
K. I. Avdienko et al 15 Jan. 1971 10 p refs Transl. into ENGLISH from the Russian
(AD-720931; FTD-HT-23-825-70) Avail: NTIS CSCL 20/2

A Ga As substrate was coated with a thin layer of Ga, sealed in an ampul containing a few pieces of Ga As and the ampul was placed in a 2-zone furnace with a small temperature gradient at less than 1000 degrees. An equilibrium vapor pressure of As was established within the ampul, and as a result an epitaxial layer of Ga As grew from the Ga layer the thickness of the epitaxial layer reached approximately 40 mu after 20–30 minutes, and decreased with increasing initial thickness of the Ga layer. The Ga As film had a single-crystal structure without stacking faults.
Author (GRA)

N71-27420# Alabama Univ., Huntsville. Research Inst.
INTRINSIC STUDIES OF MATERIALS Final Technical Report, 19 Jun. 1967–31 Aug. 1970
John F. Porter, Jr. Jan. 1971 29 p refs
(Contract DAHC04-67-C-0068)
(AD-719717; UARI-RR-99; AROD-6960:4-P) Avail: NTIS CSCL 20/12

The primary effort of this contract has been directed largely to an increased understanding of cooperative phenomena observed to occur between impurity (dopant) ions in ionic crystals. The phenomena observed were (a) ion pair absorption in LaCl3 by Ho(3+) + Nd(3+), by Ho(3+) + Pr(3+), and by Pr(3+) + Nd(3+), in which case one photon is absorbed by two ions; (b) satellite structure in which case the perturbation caused by the mutual interaction of neighboring ions produces a shift and splitting of the energy levels relative to the single Ho(3+) ion levels; (c) multiple ion relaxation processes in Ho(3+) doped LaCl3, in which case the excitation energy of a single ion is shared (nonradiatively) with one or more ions in the decay process.
Author (GRA)

N71-27422 Georgia Inst. of Tech., Atlanta.
A MOESSBAUER EFFECT INVESTIGATION OF METAMAGNETIC FeCO3
Norman Carroll Koon (Ph.D. Thesis) 1970 106 p
Avail: Univ. Microfilms Order No. 70-11190

A study of nuclear hyperfine interactions was conducted of a highly anisotropic antiferromagnet, FeCO3, using the 14.4 keV Mossbauer transition in Fe-57. Mossbauer measurements were made on single crystals of FeCO3 at temperatures from 2.5 K to above the Neel temperature of 38.2 K and in magnetic fields of up to 120 kG applied parallel to the spin ordering (trigonal) axis. Unusual broadening effects were observed which were attributed to slow electronic relaxation. A stochastic model was adapted to account for the broadening and the spectra were fitted by computer to obtain the order parameters and relaxation rates. The temperature dependence of the order parameter is consistent with that expected for a highly anisotropic, Ising-like magnetic system.
Dissert. Abstr.

N71-27423 California Univ., Los Angeles.
FAR INFRARED PHOTOCONDUCTIVITY AND ELECTRON TRANSPORT IN HIGH PURITY N-TYPE INDIUM ANTIMONIDE
Alan Joel Capell (Ph.D. Thesis) 1969 184 p
Avail: Univ. Microfilms Order No. 70-12004

A correlation was made between the electrical and photoconductive properties of selected samples of high purity n-Type InSb. Hall effect and conductivity measurements were made at liquid nitrogen and liquid helium temperatures in quantizing magnetic fields in order to characterize the electronic properties of each sample. A strong dependence of the threshold field required for carrier freezeout on the exhaustion carrier concentration indicates a strong effect of free carrier screening on the impurity-ion potential. Far infrared photoconductivity measurements were made on the same samples under similar conditions of temperature and magnetic field. It is shown that the photoconductive responsivity increases linearly with decreasing exhaustion carrier concentration for zero magnetic field, which indicates the desirability of using low carrier concentration or highly compensated material for far infrared detectors. It is also shown that the responsivity in the optimum magnetic field for each sample is independent of the exhaustion carrier concentration; although, the more compensated samples require smaller magnetic fields for optimum photoconductivity. Dissert. Abstr.

N71-27430# Stanford Univ., Calif. Microwave Lab.
THE PROPAGATION AND INTERACTIONS OF ELECTROMAGNETIC WAVES AND ACOUSTIC WAVES IN SOLIDS Final Technical Report
Marvin Chodorow Feb. 1971 46 p refs
(Contract F44620-69-C-0015)
(AD-720850; ML-1929; AFOSR-TR-71-0739) Avail: NTIS CSCL 20/12

Up to the present time nearly all work with ultrasonics has been done in inorganic crystals. Because of the continuing need for new and better materials and also the growing interest in biophysics, an investigation of the, at present, relatively unknown acoustic and photoelastic properties of organic crystals is timely and has been started in this project. The first part of the investigation is concerned with the diffraction of light by microwave sound in organic crystals whereas the second is concerned with the measurement of the elastic constants of organic and biological crystals. Measurement of the elastic constants of most of these crystals presents a problem in that they can usually be grown only in small sizes and often must be kept in a mother liquid to prevent rapid deterioration. A method of measuring some of the elastic constants under these conditions has been developed. Author (GRA)

N71-27431 Brown Univ., Providence, R.I.
SEMICONDUCTING PROPERTIES OF TUNGSTEN DISELENIDE
Lakshminarasimha Chinulu Upadhyayula (Ph.D. Thesis) 1969 100 p
Avail: Univ. Microfilms Order No. 70-8805

Single crystals of tungsten diselenide (WSe2) were prepared by chemical transport reaction using iodine or bromine as the transporting agent. The optical absorption, contact photovoltage, photoconductivity, electrical conductivity, and Hall coefficient were studied in single crystals of WSe2 over the temperature range 77 K to 295 K. It was found that the forbidden energy gap was 1.35 eV at 295 K. In the neighborhood of the absorption edge, the absorption constant showed a 3/2 power dependence on the incident photon energy when the electric vector was perpendicular to the c axis. This shows that the energy gap involved is a direct gap. The infrared transmission in these crystals showed that the reststrahlen peak occurs at 41.2 microns with the side band occurring at 20.5 microns. From the position of the reststrahlen band the force constant was found to be 96,000 dynes/cm. Dissert. Abstr.

N71-27447# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
TECHNIQUES IN THE MEASUREMENT OF ELECTRON ATTENUATION LENGTHS IN METALS
Richard Y. Koyama Nov. 1970 41 p refs
(Contract PRO-Y-71-865)
(AD-720849; AFCRL-71-0128; SR-1) Avail: NTIS CSCL 20/12

Several experimental techniques for determining electron attenuation lengths in metals in the energy range up to 100 keV are discussed. Each technique is seen to contribute data to specific regions of this spectrum, although there is a serious lack of information between 10 eV to 1 keV. In general, electron beam experiments and thin film structures are confined to specific regions in energy due to practical limitations. Vacuum photoemission does not have this limitation, although it too, has provided little data in the region of the gap between 10 eV and 1 keV. For a few materials, some data does exist and some comparisons with theory are possible. Author (GRA)

N71-27566 Virginia Polytechnic Inst., Blacksburg.
MAGNETIC PROPERTIES OF BINARY RARE EARTH ALLOYS
Arthur Holmes Millhouse (Ph.D. Thesis) 1970 146 p
Avail: Univ. Microfilms Order No. 70-11509

Single-crystal samples of Ho-Dy, Er-Gd, Er-Tb, Er-Dy, and Ho-Er alloys were prepared using the strain-anneal technique. Neutron diffraction studies of these samples have been made from room temperature to 4.2 K to determine their magnetic structure properties. In most cases a detailed study of the intensities of several important reflections was made as a function of temperature. The temperature dependence of the ordered atomic moment and its projections along the c axis and upon the crystal basal plane were calculated using the magnetic structure models proposed for the pure metals. For the alloys, these models are found to be satisfactory. In the alloy systems Er-Tb, Er-Dy, and Ho-Er, the best agreement with the measured moment values is obtained by assuming that the Tb, Dy, or Ho moments are parallel to the Er moments within hexagonal layers at 4.2 K. Dissert. Abstr.

N71-27569 Maryland Univ., College Park.
ELECTRICAL AND OPTICAL PROPERTIES OF LEAD-TIN-TELLURIDE SEMICONDUCTING ALLOYS
Richard Francis Bis (Ph.D. Thesis) 1969 109 p
Avail: Univ. Microfilms Order No. 70-12916

The electrical resistivity and Hall coefficient of the Pb sub x Sn sub(1-x)Te alloys were determined as a function of temperature from 4.2 to 300 K. These measurements were intended as a test of the band-inversion model of Dimmock, Melngailis, and Strauss in the immediate region of band crossing. The resistivity is characterized by a predominately linear dependence upon T, and by the distinct breaks which occur in this dependence. Reflectivity measurements were made in the 1-15 micron region of the spectrum on four bulk-single crystals of SnTe at 300, 80, and 10 K. In addition, reflectance measurements were made in the same spectral region on three single crystal-epitaxial films of SnTe at 300 and 80 K. The results of these measurements were analyzed in terms of a free carrier dispersion model. Comparisons of its carrier concentration and temperature dependences were made with those expected on the basis of the current band models proposed for SnTe. Dissert. Abstr.

N71-27571 Brown Univ., Providence, R.I.
ELECTRON-SPIN RESONANCE STUDIES OF IRRADIATED ALKALI-GERMANATE GLASSES AND CRYSTALLINE COMPOUNDS
Nalamolu Gopalerao (Ph.D. Thesis) 1968 102 p
Avail: Univ. Microfilms Order No. 70-8721

The ESR studies of gamma-irradiated alkali-germanate glasses and crystalline compounds are presented. The experimental phase of the present work is confined to the potassium germanate system. Measurements of the ESR spin-Hamiltonian parameters were made. A numerical simulation of the line shapes was carried out with the assistance of a newly developed computer program

and the experimental line shapes were successfully simulated using that program. The electron centers are attributed to electrons trapped at a bridging oxygen vacancy. The low-alkali glass hole centers are attributed to a hole trapped in an oxygen bridging two GeO4 units or perhaps bridging a GeO4 and GeO8 unit. The high-alkali hole centers are also attributed to a hole trapped at an oxygen bridging two GeO4 units or bridging a GeO4 and a GeO8 unit. Dissert. Abstr.

N71-27693# Watervliet Arsenal, N.Y.
COHESION AND ELASTIC MODULI
Alma M. Gray Jan. 1971 33 p
(AD-720991; WVT-7104) Avail: NTIS CSCL 20/12

This is an outline of the development of theoretical work on cohension and elastic constants. Some suggestions are made for further work in this area. The relevance to practical application is pointed out. Author (GRA)

N71-27626 California Univ., Riverside.
ANTIFERROMAGNETIC RESONANCE MEASUREMENTS IN EUROPIUM TELLURIDE
James William Battles (Ph.D. Thesis) 1969 125 p
Avail: Univ. Microfilms Order No. 70-11979

The antiferromagnetic resonance in EuTe has been measured on single crystals as a function of crystallographic direction. The resonance experiments have shown that the order in EuTe is of the easy plane type with a large anisotropy energy causing the <111> direction to be a hard direction and the (111) plane to be an easy plane. There is, in addition, a small anisotropy energy associated with the (111) plane that makes a (112) direction or equivalent, a preferred direction in the plane in zero external field. Expressed as fields, these anisotropy energies are 4,000 gauss and 8 gauss, respectively. The two resulting resonant frequencies are a high frequency branch and a low frequency which are not degenerate in zero field. From these experiments it has been determined that the zero field frequencies for resonance are 68 GHz and 2 GHz, respectively. Dissert. Abstr.

N71-27682 Virginia Univ., Charlottesville.
STUDIES OF PLASTIC DEFORMATION IN THE ZINC-CADMIUM AND COPPER-ALUMINUM ALLOY SYSTEMS
Leonard Francis Henry, III (Ph.D. Thesis) 1969 362 p
Avail: Univ. Microfilms Order No. 70-8040

The results of an investigation of the plastic deformation of single crystals of the zinc cadmium alloys are presented. Single crystals of the pure materials and their dilute alloys with a standard orientation have been subjected to tensile elongation. Surface topography and arrangements of retained dislocations associated with bands of basal slip are established and the integrated shear displacement of individual glide bands has been found to account for the total elongation of the crystals. Also, the results of an investigation of the temperature dependence of the deformation of Cu 13.2 atomic % Al single crystals and the low temperature deformation of Cu 10.5 atomic % Al single crystals are presented. The mechanism of deformation of Cu-Al single crystals involves the high velocity propagation of avalanches of dislocations. A model of the mechanism of yielding is discussed which accounts for the formation of bands of deformation through the successive generation of avalanches of edge dislocations at opposite crystal surfaces. Dissert. Abstr.

N71-27841# California Univ., Berkeley. Lawrence Radiation Lab.
WAVELENGTH MODULATION SPECTROSCOPY OF SEMICONDUCTORS
Ricardo R. L. Zucca (Ph.D. Thesis) Jan. 1971 112 p refs
(Contract W-7405-eng-48)
(UCRL-20361) Avail: NTIS

A sensitive wavelength modulation spectrometer with a spectral range from 1.75 to 6.0 eV is described. The spectrometer employs a two beam system with two feedback loops in order to compensate the dispersion of the optical components. The principles of operation, construction details and operational techniques are described. Wavelength modulation spectra of GaAs, GaSb, InAs, InSb, Ge and Si at 5, 80 and 300 K are presented. The results are compared with electroreflectance and thermoreflectance data. New structures are found in the spects of all crystals. With the help of existing band structures of these crystals, all the reflectivity peaks can be consistently assigned to proper critical transitions between the valence and the conduction bands. Values of spin-orbit splittings at several symmetry points and temperature effects on the band spectra are discussed. Author (NSA)

N71-27901# Radio Corp. of America, Princeton, N.J.
RESEARCH ON INTERNAL QUANTUM EFFICIENCY OF GaAs(1-x) p(x) AND OTHER III-V COMPOUND ELECTROLUMINESCENT DIODES Final Report, 1 Dec. 1967 - 30 Nov. 1970
Charles J. Nuese and Horst Schade 31 Dec. 1970 65 p refs
(Contract F19628-68-C-0190)
(AD-720864; AFCRL-71-0007) Avail: NTIS CSCL 9/1

The objectives of this contract have been to study parameters which affect the internal quantum efficiency of GaAs(1-x)P(x) electroluminescent diodes, and to evaluate the electroluminescence potential of new vapor-grown III-V compounds such as In(1-x)Ga(x)P and AlAs. Author (GRA)

N71-27902# Oklahoma Univ. Research Inst., Norman.
EFFECTS OF ANODIC OXIDE FILMS ON THE MECHANICAL PROPERTIES OF ALUMINUM SINGLE CRYSTALS
P. Mehdizadeh and R. J. Block Feb. 1971 64 p refs
(Contract AT(40-1)-3401)
(ORO-3401-16) Avail: NTIS

The fracture strain of the anodic coatings formed on aluminum single and polycrystalline specimens was found to decrease as the thickness of the film was increased. Stress analysis applied to the coating crystal system indicated that the coatings were under the influence of a system of biaxial stresses. Thus, the magnitude of the coating fracture strains obtained was less than the fracture strain values reported for isolated anodic films of the same thickness. Author (NSA)

N71-27903# North Carolina State Univ., Raleigh. Dept. of Engineering Research.
GRAIN BOUNDARY SLIDING IN ALUMINA BICRYSTALS Final Report
Hayne Palmour, III, W. W. Kriegel, P. F. Becher, and M. L. Huckabee Jul. 1970 22 p refs
(Contract AT(40-1)-3328)
(ORO-3328-17) Avail: NTIS

The behavior of grain boundaries during dynamic compressive deformation of alpha-Al2O3 ceramics at elevated temperatures employing single crystals, double bicrystals and polycrystalline materials was studied and the influences of temperature and strain rate on deformation modes induced during compression along the c-axis direction were observed. In the elevated temperature deformation of alumina ceramics, grain boundaries were observed to restrict or block the propagation of mechanical twins which, if operative, often resulted in crack initiation. Grain boundaries also act as dislocation barriers; but at the modest strain levels employed in the microstructural analysis samples, crack initiation as a result of dislocation pile ups was not detected. Finally, it has been shown that interfacial impurities are the most critical causative factor in obtaining grain boundary sliding in alumina ceramics. Author (NSA)

N71-27904# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DETERMINATION OF THE COEFFICIENT OF INTERNAL FRICTION OF ICE

G. N. Shimko 22 Dec. 1970 13 p refs Transl. into ENGLISH from Nauchn. Tr. Vyssh. Uchebn. Zavedenii Litovsk. SSR, Electrotekhn. i Avtomatika, 4, 1968 (Lithuania), no. 4, 1969 p 193–198

(AD-720935; FTD-MT-24-288-70) Avail: NTIS CSCL 20/12

The dependence of the dielectric permeability of ice on temperature leads to the assumption that the polar radicals in the crystal lattice can vibrate. The dielectric permeability also depends on the frequency of the applied voltage and is subject to the laws that apply to dipole liquids. The static dielectric permeability for ice is given, the optical value of the dielectric permeability is given. If the time of relaxation is known, the coefficient of internal friction can be calculated. Using the method of approximations, a given empirical formula is obtained, where T is the absolute temperature. Knowing the coefficient of internal friction, the dielectric parameters of ice can be determined within a wide frequency range and at any temperature. Author (GRA)

N71-27906# Florida Univ., Gainesville. Dept. of Metallurgical and Material Engineering.

STRUCTURE, PROPERTIES AND RADIATION SENSITIVITY OF ELECTRICALLY BISTABLE MATERIALS Annual Report, 6 Feb. 1970–6 Feb. 1971

Derek B. Dove, Larry L. Hench, Robert W. Gould, and Ronald E. Loehman 6 Feb. 1971 58 p refs

(Contract DAHC04-70-C-0024; ARPA Order 1562)

(AD-720754; TR-2; AR-1) Avail: NTIS CSCL 20/12

A range of semiconductors of compositions Ge(x)Se(1-x) and Ge(x)Te(1-x) have been prepared and have been examined by x-ray diffraction to verify the composition limits of the glass forming regions reported by previous workers. Thin films have been prepared by flash evaporation of crushed bulk compounds and have been subjected to rdf analysis and electron microscopy, and several structural models are compared. Studies on the crystallization kinetics of the glasses are being carried out with particular reference to material composition. An interpretation of these initial experiments is given in terms of a possible structural model for the glasses. The importance of crystallite size on fast neutron damage threshold in heterogeneous amorphous semiconductors is emphasized and the results of radiation experiments on vanadate glasses are discussed. Author (GRA)

N71-27907# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascati.

PRELIMINARY RESULTS REGARDING DEVELOPMENT OF SUPERCONDUCTING RIBBONS OF Nb3Sn [RISULTATI PRELIMINARI RIGUARDANTI LA REALIZZAZIONE DI NASTRI SUPERCONDUTTORI DI NB3SN]

G. Pesotti, M. V. Ricci, N. Sacchetti, G. Sacerdoti, and M. Spadoni 5 May 1970 12 p refs In ITALIAN *Its* Nota Interna 474

(LNF-70/18) Avail: AEC Depository Libraries

Preliminary results on the development of superconducting ribbons of Nb3Sn were obtained, using the method of diffusion of tin into the niobium. The production apparatus and techniques and the measuring apparatus and techniques are described. Characteristics of the superconducting ribbons produced were determined with respect to temperature. NSA

N71-27908# Iowa State Univ. of Science and Technology, Ames.

THE CRYSTAL STRUCTURE OF QUINOLINIUM NONABROMO ANTIMONATE(V), (C9H7NH)2Sb(SUP V)Br9 AND THE REFINEMENT OF THE MOLECULAR STRUCTURE OF BETA-PICOLINE N-OXIDE FUMARIC ACID ADDUCT

Elwin Ray McAfee (M.S. Thesis) Nov. 1970 33 p refs

(Contract W-7405-eng-82)

(IS-T-439) Avail: NTIS

The crystal structure of quinolinium nonabromoantimonate(V) has been determined by three dimensional X-ray analysis. The structure was solved using initially an electron density map to locate the heavy atoms, and subsequent difference electron density maps to locate the light atoms. It appears that the cation size is a strong influence on the packing position of the Br3(–) ion in the crystal lattice. The crystal structure of beta-picoline-N-oxide fumaric acid adduct was 2(C6H7NO) : (C4H4O4) was solved using a symmetry map-frequency check procedure in conjunction with a roving molecular fragment. A strong hydrogen bond between the OH group of the acid and the oxygen of the beta-picoline-N-oxide ring appears to hold the adduct together. This short O..O distance of 2.517 + or – 0.006 A lies within a range characteristic for a symmetric hydrogen bond. Author (NSA)

N71-27909# Oklahoma Univ., Norman. School of Engineering and Materials Science.

EFFECTS OF SURFACE COATINGS ON THE PLASTIC DEFORMATION OF METALS SINGLE CRYSTALS Progress Report, 15 May 1970 – 15 Feb. 1971

Robert Jay Block 15 Feb. 1971 6 p refs

(Contract AT(40-1)-3401)

(ORO-3401-15) Avail: NTIS

Research work completed during the current contract period considered the effects of anodic oxide films on the mechanical properties of aluminum single crystals. Work in progress involves studies of evaporated metal coatings on the mechanical properties of silver single crystals, the influence of anodized coatings on the fatigue behavior of 2024 Aluminum and the Rehbinder effect. Author (NSA)

N71-27910# United Kingdom Atomic Energy Authority, Harwell (England).

LOW TEMPERATURE CRYOSTAT FOR SINGLE CRYSTAL AND POWDER X-RAY DIFFRACTION

C. F. Sampson Sep. 1970 10 p

(AERE-R-6532) Avail: AEC Depository Libraries; HMSO 2s 6d; BIS $.60

A low temperature cryostat for single crystal and powder X-ray cryostat is conventional, having an outer vacuum container enclosing nitrogen and helium bins with their associated radiation shields extending throughout the lower volume of the cryostat. A small reservoir is extended from the He bin into the lower volume of the cryostat. The reservoir has a heater wound onto it, and a needle-valve control allows liquid He from the main He bin to pass into the reservoir. Temperature measurements are made using a carbon resistor and thermocouples. Temperatures down to 1.3 K were achieved by filling the reservoir with liquid He, isolating, and pumping on the exhaust line. Author (NSA)

N71-27915# Kentucky Univ., Lexington. Research Foundation.

AN RF METHOD FOR DETERMINING THE AMBIPOLAR DIFFUSION COEFFICIENT OF SEMICONDUCTORS

Ronald Maurice Cosby 1970 132 p refs

(Contract AT(40-1)-3651)

(ORO-3651-9) Avail: NTIS

The determination of the ambipolar diffusion coefficient in elemental semiconductors through measurements of the ambipolar diffusion length and lifetime of injected excess carriers in real samples is theoretically studied using three dimensional analyses including the effects of surface recombination. It is analytically shown that the diffusion length measured by the new photo-modulated RF conductivity methods and by the standard Goucher technique is an effective diffusion length which includes the effects of surface recombination and is related to the effective lifetime measured by the decay of photoconductivity from which the ambipolar diffusion coefficient is obtained. Furthermore, the steady state surface excitation of excess carriers by illumination in the

diffusion length measurements is theoretically shown to result in the same measured diffusion length as when using uniform generation obtained with penetrating light. Author (NSA)

N71-27926*# Westinghouse Research Labs., Pittsburgh, Pa.
OPTIMIZATION OF A SOLUTION GROWTH EXPERIMENT FOR ZERO GRAVITY AND DEVELOPMENT OF APPARATUS FOR A MELT GROWTH EXPERIMENT Final Report
R. G. Seidensticker, C. S. Duncan and M. Rubenstein 1971 122 p refs
(Contract NAS8-26122)
(NASA-CR-119792) Avail: NTIS CSCL 20L

An analysis is developed for the general behavior of solution growth, and the results are applied to the specific case of gallium arsenide deposited on a seed from a gallium solution. The factors governing the deposition are identified and compared with the performance of a prototype experiment package. The thermal characteristics of the experiment package, based on the heat sink system, were examined and several minor changes were found that should bring about enhanced performance. A second area of research is reported involving a melt growth experiment. The results of this effort include the design and fabrication of an experiment package for the melt growth of indium antimonide crystals. The development of the apparatus is described and a complete set of assembly and construction detail drawings are included. D.L.G.

N71-27936# Radio Corp. of America, Princeton, N.J.
ELECTRONIC PROPERTIES OF SEMICONDUCTING FERROMAGNETIC MATERIALS Final Report, 16 Dec. 1969 - 15 Dec. 1970
Avraham Amith, Stuart B. Berger, and Peter J. Wojtowicz Jan. 1971 50 p refs
(Contract F19628-70-C-0100)
(AD-720870; AFCRL-71-0029) Avail: NTIS CSCL 20/12

The research described in the report is divided into three distinct sections. The first two are concerned with studies of the electrical properties and the photoconductivity of various $CdCr_2Se_4$ materials. The goal here was to increase our understanding of the electronic centers which control the unique properties of these ferromagnetic semiconductors. The final section consists of a detailed assessment of $CdCr_2Se_4$:In as a potential improved bolometer material. Author (GRA)

N71-27940# National Aeronautical Lab., Bangalore (India).
ANOMALOUS SCATTERING OF NEUTRONS BY CRYSTALS AND THE AMPLITUDE OF VIBRATION OF LATTICE WAVES
S. Ramaseshan and K. S. Viswanathan Feb. 1970 14 p refs
(NAL-TN-21) Avail: NTIS

The scattering of neutrons by crystals, when the crystal has an atom in the unit cell that scatters neutrons anomalously was studied. Multiple phonon processes are observable in neutron scattering and no expression seems to be available for the intensities of the peaks in the second order and third order scattering. The differential scattering cross-section was derived for the third order terms. It was shown that anomalous scattering provides an important method of evaluating the amplitudes of the lattice waves in crystals. Author

N71-27978# Iowa State Univ. of Science and Technology, Ames.
STRUCTURAL, MAGNETIC, AND SPECTROSCOPIC STUDY OF NICKEL SQUARATE DIHYDRATE
Michael Habenschuss (Ph.D. Thesis, Nov. 1970) Feb. 1971 224 p refs
(Contract W-7405-eng-82)
(IS-T-432) Avail: NTIS

Samples of $NiC_4O_4 \cdot 2H_2O$, nickel squarate dihydrate, were prepared from aqueous solution and grown in silica gel. Although the powder patterns of the crystals (which grow as cubes) can be indexed assuming a cubic unit cell with a = 8.068(2)A, optical and single crystal X-ray studies reveal them to be twinned with each crystal consisting of a multiple of eight individuals. X-ray structure investigations of the twinned crystals and of fragments broken form these crystals lead to a structure belonging to the rhombohedral crystal class. The Ni atoms are at the centers of the edges of a cube. The squarate ions are in the faces. Each oxygen atom of the squarate ion coordinates a different Ni atom. Each Ni atom is coordinated roughly octahedrally by four squarate oxygens and two water oxygens. The structure has a void inside the unit cell which can accommodate extra solvent molecules. Analytical results and density measurements support such a solvent clathrate. Author

N71-27989*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
SOLID STATE MICROWAVE ELECTRONICS
D. F. Peterson Repr. from Quart. Progr. Rept. no. 101, 15 Apr. 1971 p 19-24 refs
(Grant NGL-22-009-337; Contract DA-28-043-AMC-02536(E))
(NASA-CR-118896; QPR-101) Avail: NTIS CSCL 20L

Intermodulation distortion analysis is used to obtain information about nonlinearities in an amplifier. A two tone signal is applied to the amplifier and mixes in the nonlinearity to produce odd order distortion terms in the output spectrum. The manner in which these distortion products depend on the input signal strength gives information about the nature and degree of the nonlinearity. In treating the avalanche diode amplifier, odd order distortion data are taken on an actual amplifier using a diode whose incremental impedance is known from measurements. Then, using a proposed nonlinear model for the diode, the distortion products are calculated and compared with the measured products. Author

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N71-27101# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Trauen (West Germany). Abteilung Treibstoffchemie und Treibstofftechnik.
EXPERIMENTS ON THE DEVELOPMENT OF DIIMIDE OXALIC ACID DIHYDRAZIDE AS A HYBRID FUEL [VERSUCHE ZUR ENTWICKLUNG VON DIIMIDOXALSAEUREDIHYDRAZID ALS LITHERGOLBRENNSTOFF]
Dieter Genthe Mar. 1970 35 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-52) Avail: NTIS; ZLDI Munich: 10.50 DM

The evaluation of a new hybrid fuel with nitric acid as oxidizer is described. First attempts to manufacture hybrid fuels on the basis of reaction products of aromatic amino compounds with other aliphatic or aromatic amino compounds or those of the reaction of hydrazine hydrate with aldehydes were unsatisfactory. Diimide oxalic acid dihydrazide (DODH) proved to be a hybrid fuel compound that can be used in a hybrid rocket motor successfully. The preparation of DODH, the behavior of the substance, the manufacture of fuel grains, and the behavior of the new hybrid propellant combination in motor tests are explained. Author (ESRO)

N71-27640*# Technology, Inc., Dayton, Ohio.
AN EVALUATION OF THE POST-IGNITION UNBLOCKING BEHAVIOR OF SOLID PROPELLANT AFT-END IGNITION SYSTEMS Final Report
J. D. Kilgroe, R. E. Fitch, and F. M. Placer Feb. 1971 121 p

refs
(Contract NAS3-12063)
(NASA-CR-72831; Rept-36920) Avail: NTIS CSCL 21I

Aft-end ignition experiments with heated air simulation of solid propellant exhaust were conducted to determine the postignition interactions between igniter and main motor flow. The opposed, supersonic, confined flows exhibited bimodal behavior, each mode having distinctly different main motor unblocking characteristics. Previously reported severe oscillations resulted from unstable separation of the overexpanded igniter nozzle flow, principally due to alternation between the two separation flow field structures which characterized each mode. Use of a slotted igniter nozzle successfully modified the amplitude of the oscillations and the conditions under which the oscillations occurred. Flow field analyses were conducted to aid in experimental data evaluation and in development of design criteria. Author

N71-27905# Atlantic Research Corp., Alexandria, Va.
FUNDAMENTAL DEVELOPMENT AND APPLICATION OF A REACTION RATE MODEL FOR MECHANICAL FAILURE OF VISCOELASTIC MATERIALS Final Technical Summary Report, 1 Mar. 1969–30 Nov. 1970
Courtland N. Robinson, Phillip H. Graham, and Clayton V. Bersche Mar. 1971 103 p refs
(Contract N00014-69-C-0303)
(AD-720717) Avail: NTIS CSCL 21/9

The Final Technical Summary Report presents the results obtained during an experimental program for the further development and application of a reaction rate model for mechanical failure of viscoelastic materials. The objectives of this program have been the evaluation of a general reaction rate failure model applied to fracture data obtained for a CTPB propellant and its binder and the investigation of the influence of chemical microstructure on the model parameters. A special thermal mechanical experiment wherein a uniaxial specimen of Solithane 113 was subjected to a spatially-and time-varying temperature gradient during uniaxial extension was also conducted. Author (GRA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N71-26951# Advisory Group for Aerospace Research and Development, Paris (France).
SMALL GAS TURBINES FOR HELICOPTERS AND SURFACE TRANSPORT
May 1971 141 p refs
(AGARD-LS-46-71) Avail: NTIS

CONTENTS:

1. MILITARY AND CIVILIAN NEEDS FOR SMALL GAS TURBINES D. D. Weidhuner (Army Materiel Command, Wash., D.C.) 11 p (See N71-26952 15-28)

2. THE STATE OF THE ART OF SMALL GAS TURBINE ENGINES FOR HELICOPTERS AND SURFACE TRANSPORT H. H. Langshur and B. J. Palfreeman (United Aircraft of Canada) 16 p refs (See N71-26953 15-28)

3. CYCLES OF A GAS TURBINE P. Alesi and R. Laurens (Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Villaroche, France) 11 p (See N71-26954 15-28)

4. ANALYSIS OF SMALL GAS TURBINE ENGINE COMPONENTS E. Schnell (Kloeckner-Humboldt-Deutz A.G., Oberursel, West Germany) 23 p refs (See N71-26955 15-28)

5. INDUSTRIAL AND TECHNOLOGICAL PROBLEMS OF SMALL GAS TURBINES FOR HELICOPTERS AND GROUND TRANSPORT R. M. Lucas (Rolls-Royce, Ltd., Watford, England) 13 p (See N71-26956 15-28)

6. APPLICATION TO POWER GENERATION A. L. Jaumotte (Brussels Univ., Belgium) 25 p refs (See N71-26957 15-28)

7. FUTURE DEVELOPMENTS OF SMALL GAS TURBINES J. Melchior (Atelier de Construction d'Issy-les-Moulineaux, France) 35 p (See N71-26958 15-28)

N71-26952# Army Materiel Command, Washington, D.C. Ground Mobility Div.
MILITARY AND CIVILIAN NEEDS FOR SMALL GAS TURBINES
Donald D. Weidhuner *In* AGARD Small Gas Turbines for Helicopters and Surface Transport May 1971 11 p (See N71-26951 15-28)
Avail: NTIS

The most important consideration in the selection of a power plant for any application is to maximize return on investment, or to maximize cost effectiveness; it must be indicated that the small gas turbine can yield more return or profit while satisfying operational requirements, than other engines, or its choice cannot be justified. The critical requirements of the propulsion systems for helicopters, vehicles, marine craft, electrical power generation, and total energy systems for buildings are discussed, and the engine characteristics necessary for the turbine to be the preferred choice are indicated. Installation requirements and ancillary components, exhaust emission levels and certain other technical goals are specified. Small gas turbines are arbitrarily considered to be less than 2,000 HP or less than 10 lb/sec airflow. Author

N71-26953# United Aircraft of Canada, Longueuil (Quebec).
THE STATE OF THE ART OF SMALL GAS TURBINE ENGINES FOR HELICOPTERS AND SURFACE TRANSPORT
H. H. Langshur and B. J. Palfreeman *In* AGARD Small Gas Turbines for Helicopters and Surface Transport May 1971 16 p refs (See N71-26951 15-28)
Avail: NTIS

The current technical and market status of below 1000 SHP turboshaft engines, as applied to helicopters and surface transport are reviewed. Major data are given for the successful engines and comparisons of salient design features are made. Engines now in development are discussed. On the basis of an industry survey, advances to be expected in a 1980 helicopter engine are described and the expectations are critically reviewed. 1980 surface transportation engines are treated similarly, though in less technical detail. The main challenges for the engine designer and manufacturers in the surface transport field are brought out. Author

N71-26954# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Villaroche (France).
CYCLES OF A GAS TURBINE [CYCLES DE TURBINES A GAZ]
P. Alesi and R. Laurens *In* AGARD Small Gas Turbines for Helicopters and Surface Transport May 1971 11 p In FRENCH (See N71-26951 15-28)
Avail: NTIS

The power of a gas turbine is defined by the following four parameters: air flow; overall pressure ratio, turbine inlet temperature, and components efficiencies. The flow depends directly on turbomachine geometry whereas the compression rate is a cyclic variable. The temperature in front of the turbine is also a cyclic variable but its value is limited by cooling problems of the turbine materials. Compression output and loss are functions of geometry at each cycle stage before flow clearance is minimized through increased compression. It is concluded that the power of

a gas turbine is primarily determined by its thermodynamic cycle and its geometrical shape. Transl. by G.G.

N71-26955# Kloeckner-Humboldt-Deutz A.G., Oberursel (West Germany).
ANALYSIS OF SMALL GAS TURBINE ENGINE COMPONENTS
Erwin Schnell *In* AGARD Small Gas Turbines for Helicopters and Surface Transport May 1971 23 p refs (See N71-26951 15-28)
Avail: NTIS

Aircraft gas turbines are to be developed for lowest weight and smallest volume; therefore they are built without utilization of the exhaust heat but for high pressure ratios. For vehicle gas turbines, however, the specific fuel consumption is the determining factor and therefore the heat exchanger is an essential component of the engine. For small gas turbine engines cooled turbine blades can only be used to a limited extent. In certain cases higher efficiencies can be expected with radial turbines than with axial turbines having unfavorable aspect ratios. Two shaft engines (having a free power turbine) compete with single shaft engines; auxiliary attachments (hydraulic torque converter or hydrostatic transmission) render the single shaft engine feasible to be used for traction purposes. Author

N71-26956# Rolls-Royce, Ltd., Watford (England). Small Engine Div.
INDUSTRIAL AND TECHNOLOGICAL PROBLEMS OF SMALL GAS TURBINES FOR HELICOPTERS AND GROUND TRANSPORT
R. M. Lucas *In* AGARD Small Gas Turbines for Helicopters and Surface Transport May 1971 13 p (See N71-26951 15-28)
Avail: NTIS

After considering why a small engine needs to rotate fast, and be made of integral rather than built up parts, some of the consequent vibratory problems are discussed with the conclusion that methods of introducing damping into the system are required. Fuel system limitations due to dirt being the same size for big and small engines limit the use of scaled down large enging designs. Contamination of compressors by foreign objects is similarly more pronounced. A number of workshop problems special to small size are considered and shown to respond to the use of suitable techniques. Finally a glance at some of the costs which don't scale indicate proportionately high launching costs. Author

N71-26957# Brussels Univ. (Belgium).
APPLICATION TO POWER GENERATION
Andre L. Jeumotte *In* AGARD Small Gas Turbines for Helicopters and Surface Transport May 1971 25 p refs In FRENCH and ENGLISH (See N71-26951 15-28)
Avail: NTIS

The applications of gas turbines of low power (below 500 kW) in the fields of aeronautics, industry and space are reviewed and the advantages and drawbacks of gas turbines in comparison with Diesel engines are discussed. The use of small turbines for the combined production of electric and thermal energy is considered. The thermodynamic characteristics of the total energy system are described and a few examples of industrial applications given. Possibilities offered by the use of gas turbines in space research, especially as regards the production of the energy required on board exploration vehicles are outlined. Author

N71-26958# Atelier de Construction d'Issy-les-Moulineaux (France).
FUTURE DEVELOPMENTS OF SMALL GAS TURBINES [DEVELOPPEMENTS FUTURS DES PETITES TURBINES A GAZ]
Jean Melchior *In* AGARD Small Gas Turbines for Helicopters and Surface Transport May 1971 35 p In FRENCH and ENGLISH (See N71-26951 15-28)
Avail: NTIS

Light engines with powers ranging between 300 and 1500 hp will be essentially used for the propulsion of ground vehicles, that is for industrial applications. 1.5 kg of weight per hp. should satisfy most users. A lower weight will be appreciated, of course, but not at any cost. Fuel consumption, in particular, will remain an important item in the cost of operation. Besides, the air intake, filtering, sound-proofing and exhaust devices are costly and bulky. Since they are proportional to the air flow rate, they will be three times larger for a turbine than for a diesel engine. The cost per hp. of present diesel engines remains an objective for the gas turbine to reach. Now, this cost should still decrease considerably with high super-charging simultaneously with the weight per hp., which should reach 1 kg/hp. in the near future. The essential asset of the turbine is its extremely light weight, which is however counterbalanced by the heat recovery device. Author

N71-27094* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICRO-POUND EXTENDED RANGE THRUST STAND Patent
Kenneth W. Stark, inventor (to NASA) Issued 23 Mar. 1971 4 p Filed 29 May 1969 Cl. 73-117.4; Int. Cl. G01l5/00
(NASA-Case-GSC-10710-1; US-Patent-3,572,104; US-Patent-Appl-SN-828909) Avail: US Patent Office CSCL 21H

The thrust stand comprises a vertical tubular member rotatably held at both ends by flexible pivots. A horizontal support beam is attached to the tubular member and supports a thruster package at one end. A counter weight is mounted on the other end of the support beam to balance the weight of the thruster package. A sensor is provided for sensing the movement of the beam caused by low level thrusts. A magnetic forcer is provided for counteracting higher level thrusts so that a null balance system is provided for testing higher level thrusts. Suitable electronic means are provided for controlling the operation of the thruster and for telemetering data from the sensor and other measuring devices. Official Gazette of the U.S. Patent Office

N71-27095* Brown Engineering Co., Inc., Huntsville, Ala.
THRUSTER MAINTENANCE SYSTEM Patent
Jerry P. Hethcoat and Roland H. Norton, inventors (to NASA) Issued 30 Mar. 1971 6 p Filed 9 Jul. 1971 Cl. 244-1; Int. Cl. B64g1/00 Sponsored by NASA
(NASA-Case-MFS-20325; US-Patent-3,572,610; US-Patent-Appl-SN-840176) Avail: US Patent Office CSCL 21H

The thruster is mounted on the exterior surface of a panel removably mounted on the spacecraft wall. A portable airlock is provided which may be sealed to the interior surface of the spacecraft wall about the removable panel. An operator within the spacecraft inserts his arms into space suit-type gloves extending into the airlock which enable him to remove the thruster panel and replace it with a new panel, afterwhich the portable airlock may be removed from the spacecraft wall.
Official Gazette of the U.S. Patent Office

N71-27281# ARO, Inc., Arnold Air Force Station, Tenn.
SOME EXPERIMENTAL TESTS TO CHANGE THE TOTAL VOLUME AND/OR MOLECULAR WEIGHT OF ROCKET ENGINE EXHAUST GAS IN AN ALTITUDE TEST FACILITY Final Report, Sep. 1967 - Jul. 1970
A. J. Zazzi, J. R. McDowell, and J. W. Hale AEDC Mar. 1971 57 p ref
(Contract F40600-71-C-0002)
(AD-721209; AEDC-TR-71-13) Avail: NTIS CSCL 21/1

The investigation was conducted mainly to determine the possibility of burning fuel-rich combustible exhaust gas mixtures by the injection of either gaseous oxygen or gaseous carbon dioxide into the exhaust stream. The burning of the combustibles, especially hydrogen, results in a large volume decrease when the hot gas is

cooled. The reaction of the oxygen or carbon dioxide with combustible products (hydrogen rich in this test) was possible, as evidenced by the results of the chemical analysis of the exhaust products. The possibility of generating an electrostatic field along the viscous mixing boundary between two gases was studied using argon, helium, and stream jets at different energy levels. An electrostatic field along the viscous mixing boundary between two gases (one being steam) was produced in an ungrounded installation; even with only a steam jet in an ungrounded installation, an electrostatic field was generated. Author (GRA)

N71-27585* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PERSONAL PROPULSION UNIT Patent
Robert M. Croft, Alfred G. Orillion, and Thomas W. Barrett, inventors (to NASA) Issued 16 Mar. 1971 10 p Filed 24 Mar. 1969 Cl. 244-4; Int. Cl. B64c39/00
(NASA-Case-MFS-20130; US-Patent-3,570,785; US-Patent-Appl-SN-809822) Avail: US Patent Office CSCL 21H

A monopropellant propulsion system which is used as an assist unit to augment an astronaut's jumping ability on the lunar surface is presented. The unit is composed of a tubular framework which fits onto the shoulders of an astronaut and supports a disposable propellant tank adjacent the astronaut's chest and has thrusters adjacent each side of the astronaut about at the level of the hips. Propellant lines are contained within the tubular framework. Controls are provided for tilting the thrusters toward the front and back as well as for throttling the thrusters. Extension may be added to the tubular framework to achieve different configurations, such as would be suitable for cargo handling. Official Gazette of the U.S. Patent Office

N71-27934*# Aerojet Solid Propulsion Co., Sacramento, Calif.
DEMONSTRATION OF A STERILIZABLE SOLID ROCKET MOTOR SYSTEM Final Report
D. O. De Pree Jan. 1971 94 p refs
(Contract NAS1-10088)
(NASA-CR-111889) Avail: NTIS CSCL 21I

This successful demonstration of the heat sterilization of case-bonded, insulated and lined solid rocket strain motors was made possible by a careful analysis of the chemical, physical and mechanical problem imposed by heat sterilization. The demonstration provides the basis for design, fabrication, sterilization and testing of full-scale motors. Each of the motor components previously developed specifically for the heat sterilization application was tested both individually and in composite systems. On the basis of a stress analysis derived from a full characterization of the propellant and propellant-liner-insulation bond, a grain configuration and strain levels were selected for the strain motor demonstration. Three strain levels were selected: (1) a level at which failure would be anticipated, (2) a strain level believed to be marginal and (3) a strain level projected to survive. In addition to these motors a motor having a stress relief liner-insulation was designed and fabricated as a back-up configuration. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N71-26891# Tokyo Univ. (Japan). Inst. for Nuclear Study.
CALCULATION OF THE EFFECTIVE AREA IN A HORIZONTAL AIR-SHOWER OBSERVATION DEVICE
Motohiko Nagano Jun. 1970 20 p refs In JAPANESE; ENGLISH summary
(INS-TCA-27) Avail: AEC Depository Libraries

The effective area times solid angle for triggering the horizontal air showers is calculated for three different triggering requirements in an INS AS array. The fluctuation of the number of particles in the scintillation detector and the variation of the path length in the scintillator of 5 cm thickness for inclined showers are taken into account. Author (NSA)

N71-27048# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany).
EXTENSIVE AIR SHOWERS
J. Truemper Sep. 1970 24 p refs Presented at the 6th Interam. Seminar on Cosmic Rays, La Paz, Bolivia, Jul. 1970
(MPI-PAE/Extraterr-47; Conf-700708-2) Avail: AEC Depository Libraries

Topics discussed include air shower evidence of quarks, evidence of large transverse momenta in air shower cores, primary energy spectrum, chemical composition, arrival direction distribution, possible role of pulsars as cosmic-ray accelerators at air shower energies, apparent isotropy at 10 to the 18th power eV, chemical composition of pulsar produced cosmic rays, and pulsed neutron sources. NSA

N71-27102# Tokyo Univ. (Japan). Inst. for Nuclear Study.
DEVICE FOR OBSERVING THE ENTRY DIRECTION OF AIR SHOWERS
Hiromitsu Akiyama Oct. 1969 22 p In JAPANESE
(INS-TCA-26) Avail: AEC Depository Libraries

In observation of extensive air showers, it is important to know the direction of their entry by stereo-arrangement of the counters. The conventional system of the chronotron type is laborious in the film development, reading, etc. Scintillation detector arrays, transistorization of an electronic system, and also transistorized automatic digital recorder were developed previously. Subsequently, the device (transistorized) for observing the entry direction of air showers was completed. The detectors are located at the five corner points of a regular pyramid. The measured values are punched in the same tapes for particles counters in digital quantities. The tapes are processed directly in a computer, and the entry direction of air showers is given for each individual shower. Compared to the chronotron-type system, the maintenance and the data analysis are both greatly simplified. NSA

N71-27280# Consejo Nacional de Investigaciones Cientificas y Tecnicas, Buenos Aires (Argentina).
X-RAY SPECTROMETRY OF GALACTIC SOURCES SEEN FROM THE SOUTHERN HEMISPHERE
Horacio E. Bosch 10 Mar. 1971 4 p
(Grant AF-AFOSR-1592-68)
(AD-720895; AFOSR-TR-71-0726) Avail: NTIS CSCL 3/2

The main subject of the investigation performed under the auspices of the AFOSR-68-1592 Grant was the study of the galactic X-ray sources seen from the southern hemisphere. As a byproduct, the detection of soft X-rays following the electron-capture decay of radioactive sources was studied. The investigation on glactic X-rays was centered in one experiment carried out in Argentina in November 28, 1969. A balloon-borne equipment was launched in order to detect the X rays from the Centaurus XR-4 source. Author (GRA)

N71-27282# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
CHANGES IN THE DISTRIBUTION OF LOW-ENERGY TRAPPED PROTONS ASSOCIATED WITH THE 17 APRIL 1965 MAGNETIC STORM
A. L. Burns and S. M. Krimigis Mar. 1971 55 p refs
(Contract N00014-68-A-0198-0003)
(AD-721082; Rept-71-8) Avail: NTIS CSCL 4/1

The absolute intensity of geomagnetically trapped protons in the energy ranges 0.52 = or < E sub p = or < 4.0 Mev and 0.90 = or < E sub p = or < 1.8 Mev has been measured with the solid state proton detector on the University of Iowa low altitude (initial apogee 2502 km, perigee 527 km), high latitude (inclination 81 deg) satellite Injun 4 for the period March 1 to May 31, 1965. A study of the temporal variations of these fluxes associated with the April 17, 1965, magnetic storm (sc 1313 UT April 17, main phase onset about 0200 UT April 18) shows a general redistribution of these protons for L greater than or approximately equal to 2.5 and all sampled/B/ ranges, which persisted for at least 36 days after the storm. Author (GRA)

N71-27493 Wisconsin Univ., Madison. Space Science and Engineering Center.

SATELLITE OBSERVATIONS OF THE EARTH'S RADIATION BUDGET, 1962–1965

Thomas H. Vonder Haar and Verner E. Suomi *In* WMO Radiation Including Satellite Tech. 1970 p 55–57 (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

A comprehensive radiation climatology of the earth's atmosphere system based on all available satellite measurements during the period from 1962 to 1965 is presented. Mean annual and seasonal values of the planetary albedo, outgoing long-wave radiation, and net radiation have been derived for the entire earth, the northern and southern hemispheres, latitudinal zones and geographical locations. ESRO

N71-27501 World Meteorological Organization, Geneva (Switzerland).

SOME RESULTS OF MEASUREMENTS OF EARTH BRIGHTNESS BY THE SATELLITE COSMOS 149

M. S. Malkevich, L. G. Istomina, G. V. Rozenberg, and V. I. Syachinov *In its* Radiation Including Satellite Tech. 1970 p 101–110 refs (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

Experimental data of solar radiation reflected by the earth has been obtained by three-channel medium-resolution telephotometers on Cosmos 149. The reliability of the measurements, the brightness data obtained, and the angular distribution of reflected solar radiation are discussed. ESRO

N71-27532 Lille Univ. (France). Dept. of Physics.

ASYMPTOTIC PARTIALLY POLARIZED LIGHT IN A SCATTERING AND ABSORBING MEDIUM

M. Herman *In* WMO Radiation Including Satellite Tech. 1970 p 299–303 refs (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

A plane parallel scattering and absorbing medium receiving on its upper surface a uniform and parallel beam of radiation is considered. The scattered light inside the medium, taking into account polarization is analyzed. ESRO

N71-27534 Paris Univ. (France).

STUDY OF LUMINOUS FLUXES DIFFUSED AND TRANSMITTED WITHIN A LAYER OF ILLUMINATED FOG

J. Bricard, M. Fournet (Sud-Aviation, Courbevoie, France), and J. Lenoble (Lille Univ.) *In* WMO Radiation Including Satellite Tech. 1970 p 311–315 refs (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

For general radiation transfer studies an artificial cloud was illuminated by an assembly of luminous sources simulating a solar beam. A large abnormal reduction of the overall flux propagated within the cloud was observed. ESRO

N71-27538 Ludwig-Maximilians-Universitat, Munich (West Germany). Meteorologisches Inst.

OPTICAL DETERMINATION OF THE CONTINUUM ABSORPTION OF MARITIME AIR MASSES IN THE SPECTRAL REGION OF SOLAR RADIATION

H. Quenzel *In* WMO Radiation Including Satellite Tech. 1970 p 331–334 (See N71-27484 15-13)

Copyright. Avail: Issuing Activity

The radiation transfer in the spectral region of solar radiation (from 0.3 to 3 microns) is described by looking for a process of continuum-absorption. This process together with scattering by air molecules and aerosols is discussed. ESRO

N71-27639*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE ISOTROPY OF THE COSMIC gamma RAY FLUX BETWEEN 1 and 6 MeV AND ITS IMPLICATIONS FOR FUTURE gamma RAY INVESTIGATIONS

F. W. Stecker, J. I. Vette, and J. I. Trombka May 1971 14 p refs

(NASA-TM-X-65562; X-641-71-201) Avail: NTIS CSCL 03B

The alternative hypotheses of galactic and extragalactic origin of the observed cosmic gamma ray flux between 1 and 6 MeV is examined in the light of the most recent spectral information on cosmic rays above 50 MeV. It is concluded that the present data on cosmic gamma rays are not consistent with 1-6 MeV gamma ray spectra generated by diffuse galactic production processes. Thus, the 1-6 MeV flux is, in all likelihood, extragalactic. It is, therefore, a strong background upon which both galactic and extragalactic point-sources in this energy region will be superimposed. This necessitates the use of high angular resolution gamma ray telescopes in order to study possible discrete sources in the 1-15 MeV energy region. Author

N71-27644*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE NORMALIZATION OF SOLAR X-RAY DATA FROM MANY EXPERIMENTS

Charles D. Wende May 1971 86 p refs Submitted for publication

(NASA-TM-X-65553; X-601-71-166) Avail: NTIS CSCL 03B

A conversion factor is used to convert Geiger (GM) tube count rates or ion chamber currents into units of the incident X-ray energy flux in a specified passband. A method is described which varies the passband to optimize these conversion factors such that they are relatively independent of the spectrum of the incident photons. This method was applied to GM tubes flown on Explorers 33 and 35 and Mariner 5 and to ion chambers flown on OSO 3 and OGO 4. Revised conversion factors and passbands are presented, and the resulting absolute solar X-ray fluxes based on these are shown to improve the agreement between the various experiments. Calculations have shown that, although the GM tubes on Explorer 33 viewed the sun off-axis, the effective passband did not change appreciably, and the simple normalization of the count rates to the count rates of a similar GM tube on Explorer 35 was justified. Author

N71-27648*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NUCLEAR COMPOSITION AND ENERGY SPECTRA IN THE 12 APRIL 1969 SOLAR PARTICLE EVENT

D. L. Bertsch, C. E. Fichtel, and D. V. Reames Jun. 1971 22 p refs Submitted for publication

(NASA-TM-X-65573; X-662-71-210) Avail: NTIS CSCL 03B

The charge composition for several of the multicharged nuclei and the energy spectra for hydrogen, helium, and medium (6 < or = to Z < or = to 9) nuclei were measured in the April 12, 1969 solar particle event. The energy/nucleon spectral shape of the medium nuclei was again the same as that of the helium nuclei, and the ratio of these two species was consistent with the present best average of 58 + or − 5. By combining the results obtained here with previous work, improved estimates of the Ne/O

and Mg/O values of .16 + or − .03 and .056 + or − .014 respectively were obtained. Si and S abundances relative to O were determined to be .028 + or − .010 and .008 + or − .006 respectively, and 85% confidence upper limits for A and Ca relative to O of .017 and .010 were obtained. Author

N71-27646*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METAGALACTIC gamma-RAYS FROM RELATIVISTIC ELECTRON BREMSSTRAHLUNG INTERACTIONS
F. W. Stecker and D. L. Morgan, Jr. (NAS-NRC) Jun. 1971 19 p refs Submitted for publication
(NASA-TM-X-65577; X-641-71-226) Avail: NTIS CSCL 03B

Gamma ray spectra calculated for relativistic electron bremsstrahlung interactions are presented. It is concluded that such spectra cannot match the form of the observed spectrum above 1 MeV as was previously suggested. Author

N71-27702*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECTS OF PROPAGATION AND SOURCE DISTRIBUTION ON COSMIC RAY COMPOSITION AND ANISOTROPY
R. Ramaty and R. E. Lingenfelter (Calif. Univ., Los Angeles) May 1971 39 p refs Presented at the Discussion on the Isotopic Composition of Cosmic Ray Nuclei, Lyngby, Denmark, 23 – 25 Mar. 1971 Submitted for publication
(NASA-TM-X-65575; X-660-71-221) Avail: NTIS CSCL 04A

The problems of fragmentation and anisotropy are treated within specific models for cosmic ray propagation and source distribution. The principle requirement for various models considered is that they should be capable of holding particles in dense regions of the galactic disk for periods of time sufficient to produce the observed fragmentation products of cosmic rays. The discussion is limited to propagation by diffusion, both simple and compound. General transfer equations are formulated which take into account these forms of propagation as well as nuclear fragmentation and energy loss. Both continuous and discrete source distributions are considered and solutions of the transfer equations are presented for ultrarelativistic as well as mildly relativistic particles. The results of anisotropy calculations with these models are compared with observed upper limits. D.L.G.

N71-27703# Fraunhofer-Gesellschaft, Garmisch-Partenkirchen (West Germany). Physikalisch-Bioklimatische Forschungsstelle.
[DIURNAL Be 7 AND P 32 FALLOUT DATA] Progress Report, 1 Apr. – 1 Dec. 1970
1 Dec. 1970 18 p
(Contract AT(30-1)-4061)
(NYO-4061-3) Avail: NTIS

The results obtained from 1 Apr. to 15 Nov. 1970 by daily monitoring of the atmosphere at Zugspitze, Germany for Be-7, fallout, and P-32 are presented. The sampling and separation equipment and methods used are described. The analyzer used for determinating the gamma spectrum of the chemically separated fallout radioactivity is discussed. Meteorological data were obtained from 2400 radiosonde ascents, and used for deriving theoretical expressions for exchange processes in the atmosphere, particularly stratospheric-tropospheric exchange. Work on a computer program to evaluate the theoretical studies of the exchange processes and to correlate the results of the valuations with Be-7, fallout, and P-32 data was initiated. NSA

N71-27704*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF THE SOLAR LONG TERM VARIABILITY AND IRRADIANCE IN THE NEAR AND FAR ULTRAVIOLET
Donald F. Heath Feb. 1971 31 p refs Submitted for publication
(NASA-TM-X-65551; X-651-71-116) Avail: NTIS CSCL 03B

Satellite observations of the ultraviolet solar flux at selected wavelength bands between 1200 and 3000A were made continuously by a broad band photometer on Nimbus 3(launched April 1969) and Nimbus 4(launched April 1970). In addition, measurements were made at 12 wavelengths from 2550-3400A which views the sun once per orbit from Nimbus 4. Two UV active regions with a 27 day period were observed since the launch of Nimbus 3. UV flux variations decrease rapidly with wavelengths measuring from 1200A to 3000A. Twenty-seven day variations in the Lyman- alpha and 1350-1600A channel have declined from a maximum variability of 40% (solar rotation No. 1549) to about 7% after 20 solar rotations. At 1600A the 27 day variability has declined from 6% to 4% over the same period. The UV activity observed at these wavelengths correlates with both the variations in the 10.7 cm flux and with the daily Sigma Kp index (when > 40) as well as with certain observed UV active regions. The maxima in Sigma Kp occur generally 1-3 days after the UV maxima. Considering similar measurements from a rocket flight in 1966 together with the Nimbus 3 and 4 observations, it is evident that there is also a very significant variation of the solar UV flux at 1600A, which originates in regions of low solar temperatures, with the 11 year solar cylce. Author

N71-27792*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE RISK OF SOLAR PROTON EVENTS TO SPACE MISSIONS
M. O. Burrell Washington Jun. 1971 64 p refs
(NASA-TN-D-6379; M-439) Avail: NTIS CSCL 22A

The total dose from solar protons was tabulated in rads-tissue for weekly time intervals, and the number of weeks that gave a dose above 25 rads behind 10 g/sq m of aluminum for the active six years of the 19th cycle were called dangerous or large event weeks. Only three such event weeks were found during the past 20 years. Even though the possibility of smaller events was examined, it was found that for any reasonably high confidence level (95 percent), the smaller events could be ignored. Consequently, the total particle flux for the 19th cycle was divided by a factor of three, and a single large event week was determined. The Poisson distribution was the most logical choice for predicting the probability of an event occurring. This conclusion and the methods of using this probability model are examined. The confidence one could use in employing the Poisson process and specifically arriving at confidence levels for the experimental or observed value of the mean of the Poisson distribution function is defined. Several examples are given for different mission lengths, and comparisons to the results of other authors are made. Author

N71-27823# Universidad Mayor Desan Andres La Paz (Bolivia). Lab. de Fisica Cosmica.
ON THE STUDY OF COSMIC RAYS AT CHACALTAYA, 1966 – 1970 Final Technical Report
Gaston R. Mejia and Carlos Aguirre Oct. 1970 60 p refs
(Grant AF-AFOSR-1643-69)
(AD-720896; Rept-37; AFOSR-70-2511TR) Avail: NTIS CSCL 4/1

The aims of the experiment were to study high energy interactions produced by surviving primary protons of the cosmic radiation at the altitude of Chacaltaya (5200 m.a.s.l.). In 1965, a preliminary experiment performed at Chacaltaya, showed that the energy spectrum in the range 10 to the 12th power to 10 to the 14th power eV, was steeper than the total energy spectrum of Cosmic Rays. The present experiment aim was to confirm this preliminary result. This report presents details on the different experimental arrangements used and the scientific results obtained, which were presented in the eleventh International Conference on Cosmic Rays, Budapest, Hungary and at the sixth Interamerican Seminar on Cosmic Rays, La Paz, Bolivia. Author (GRA)

N71-27824# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ARBITRARY AMPLITUDE MAGNETO-ACOUSTIC WAVES UNDER GRAVITY: AN EXACT SOLUTION Technical Report, Jun. – Dec. 1970
Yam T. Chiu 15 Mar. 1971 37 p refs
(Contract F04701-70-C-0059)
(AD-720244; TR-0059(6260-10)-8; SAMSO-TR-71-36) Avail: NTIS CSCL 3/2

The author obtains exact Riemannian wave solution to the magnetohydrodynamic equations for a compressible medium under the influence of a gravitational field. The method of solution consists of an application of Hamburgers subsidiary equations previously found useful in the analysis of such three-dimensional waves in compressible hydrodynamics under gravity. The resultant magneto-acoustic waves cannot be classified as slow and fast modes, and their propagation characteristics are found to be quite different from those in a uniform medium. In particular, the phenomenon of large amplitude wave ducting is examined. Certain wave properties correspond exceedingly well with the observed fine structure of waves propagating away from solar flares. Author (GRA)

N71-27825# Institute of Nuclear Research, Warsaw (Poland).
INTERPRETATION OF THE DATA ON MUONS IN COSMIC RAYS FROM THE POINT OF VIEW OF HIGH ENERGY PHYSICS AND ASTROPHYSICS [INTERPRETACJA POMIAROW WLASNOSCI MIONOW PROMIENIOWANIA KOSMICZNEGO Z PUNKTU WIDZENIA FIZYKI ODDZIALYWAN WYSOKICH ENERGII I ASTROFIZYKI]
J. Wdowczyk 1970 108 p refs In POLISH; ENGLISH summary
(INR-1231) Avail: AEC Depository Libraries

The possibility of the application of the EAS method in the physics of high-energy interactions and astrophysics is discussed. The discussions are based on the analysis of three physical problems: the mass composition, the dependence of mean transverse momentum on the primary energy, and the multiplicity of pion production at extremely high energies. It is shown that the data on muons in cosmic rays indicate that the beam of high-energy primary cosmic rays contains more protons than the beam at lower energies available for direct investigations. The most likely explanation of this effect is the assumption that the primary nuclei are fragmentated in the vicinity of their sources. On the basis of investigations of the lateral distribution of high-energy muons it is shown that the mean transverse momentum of pions produced in interactions of energies 10 to the 14th power eV is about 0.6 to 0.7 GeV/c. Author (NSA)

N71-27826*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA RAY OBSERVATIONS OF THE GALACTIC CENTER AND SOME POSSIBLE POINT SOURCES
C. E. Fichtel, R. C. Hartman, D. A. Kniffen, and M. Sommer (NAS-NRC) Jun. 1971 22 p refs Submitted for publication
(NASA-TM-X-65564; X-662-71-209) Avail: NTIS CSCL 03B

A .5 m by .5 m digitized spark chamber gamma ray telescope was flown on three balloon flights to look at the galactic center region, Virgo, and the Crab. An excess flux above atmospheric background of over four standard deviations was found for gamma rays exceeding 100 MeV coming from the galactic center region, corresponding to a line intensity of 2.0 + or – 0.6 × 0.0001 gammas/(sq-cm rad sec), but there was no statistically significant excess in the 50 to 100 MeV interval, with a 95% confidence limit for the ratio (J(50–100 MeV)/J (> 100 MeV)) being 0.50. As a result, there is only a 6% chance that Compton or synchrotron radiation from electrons with a power law spectrum having an exponent of 2.6 could make as much as a 50% contribution to the gamma radiation in this energy range. No positive evidence was found for radiation from any of the sources M 87, 3C273, and the Crab Nebula, and 95% confidence upper limits for the gamma ray flux from these objects were set at 0.00001, 0.00001, and 0.00006/(sq-cm sec) respectively. The M-87 limit eliminates the possibility that the power law spectrum observed at X-ray energies extends unchanged to the high energy gamma ray region. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N71-26808*# Yale Univ., New Haven, Conn. Dept. of Geology and Geophysics.
PYROXENES AND OLIVINES IN CRYSTALLINE ROCKS FROM OCEAN OF STORMS
Neville L. Carter, Louis A. Fernandez, Hans G. Ave'Lallemant (Rice Univ.), and Irene S. Leung [1971] 31 p refs
(Contract NAS9-9937)
(NASA-CR-115030) Avail: NTIS CSCL 03B

Crystalline rocks from Apollo 12 flight have been examined in detail to determine the petrology and deformational state principally of the pyroxenes and olivines. All four rocks have subophitic textures and are composed predominantly of intermixed pigeonite and augite, calcic plagioclase and zero to thirty percent olivine. Ilmenite, cristobalite and glass are accessories. Many pyroxenes are elongated and contain (100) growth twins along which pigeonite has exsolved. The liquidus fractionation trend (commonly discontinuous) normal to (100) is subcalcic augite yielding Fe-rich pigeonite yielding Fe-rich subcalcic augite and calcic pigeonite yielding ferrohedenbergite. The elements Ti, Al, and Cr are enriched in augite relative to pigeonite and the distribution of Ti and Al suggests that a low pressure coupled substitution dominates. Author

N71-26860# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 251 28 Apr. 1971 p 1–5 refs (See N71-26859 15-13)
Avail: NTIS

A news brief describing a double telescope for synchronous photoelectric measurements, and abstracts of scientific articles are presented. Topics of the abstracts include properties of the Martian surface, and properties of the Venusian and Jovian atmosphere. F.O.S.

N71-26872# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astronomy and Space, No. 250 16 Apr. 1971 p 1–6 refs (See N71-26871 15-13)
Avail: NTIS

The Rt-22 radio telescope, an antenna on an azimuthal mounting as a fully rotatable parabolic reflector, is investigated for its accuracy in guidance and smooth tracking. The completion of the electronic control system for the giant telescope of the Zelenchukskaya Astrophysical Observatory is reported. The discovery of magnetic field clouds near the sun is announced. Abstracts are also presented on various astronomical literature, including relative photometry of solar corona, brightness bursts of two comets, and radio emission of Uranus at wavelength 8.22 mm. J.A.M.

N71-26902# Joint Publications Research Service, Washington, D.C.
ASTRONOMY

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 252 14 May 1971 p 1–4 refs (See N71-26901 15-13)
Avail: NTIS

An investigation of the optical properties of the earth's atmosphere is discussed. Three important problems of atmospheric optics are presented: (1) the instability of the earth's atmosphere (scintillation and quivering of the images of stellar objects and the astroclimate), (2) the transparency of the earth's atmosphere, and (3) the investigation of the optical properties of the earth's atmosphere by the method of twilight observations. The collection is based on material presented at a conference of working groups of the Astrosovet of the USSR Academy of Sciences on the optical instability of the earth's atmosphere which was held in Uzhgorod in October 1968. Author

N71-26980# Los Alamos Scientific Lab., N.Mex.
LABORATORY MODELING SIMULATION OF COMET PHENOMENA
E. A. Kaimakov et al Dec. 1970 10 p refs Transl. into ENGLISH from Transactions of the 6th Ann. All Union Winter School on Cosmological Phys. (USSR), 1970 p 15–20
(LA-tr-70-27) Avail: NTIS

Several hypotheses concerning the structure and composition of comet cores are mentioned. Investigations carried out at the Ioffe Institute on the behavior in vacuum of H_2O ices and aqueous solutions of electrolytes at low temperatures are described. The behavior of dust particles as possible contaminants of ice cores is discussed. NSA

N71-26989*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AIRBORNE METEOR OBSERVATIONS AT HIGH LATITUDES
K. Stuart Clifton Washington Jun. 1971 56 p refs
(NASA-TN-D-6303; M438) Avail: NTIS CSCL 03B

Meteor observations made by two low light level television systems, an image orthicon, and a secondary electron conduction vidicon, located aboard the 1969 NASA Airborne Auroral Expedition are discussed. The experiment is described, and analysis procedures are defined. A comparison is made of the results observed by the two systems. The meteor influx rates observed at latitudes between 50 and 80 deg are reported. The data are examined for diurnal, directional, and latitudinal effects. A detailed listing of the data is presented. Author

N71-26991*# National Aeronautics and Space Administration. Washington, D.C.
EARTH ORBITAL SCIENCE (SPACE IN THE SEVENTIES)
William R. Corliss Apr. 1971 34 p Original Contains Color Illustrations
(NASA-EP-83) Avail: NTIS; SOD $1.00 CSCL 03B

Planned research programs in atmospheric physics and space astronomy are reviewed, and the satellites to be used are briefly described. The satellites for observing atmospheric structure, composition, particles, and fields are the Interplanetary Monitoring Platforms, Small Scientific Satellite, and Atmosphere Explorers. Those planned for examining the sun, the stars in the Milky Way, and astrophysics and cosmology include Orbiting Solar Observatories, Orbiting Astronomical Observatory, Small Astronomy Satellite, High Energy Astronomy Observatory, and Radio Astronomy Explorer. The instrumentation and type of measurements for each satellite are mentioned. N.E.N.

N71-27617# Paris Observatory, Meudon (France). Lab. of Stellar and Planetary Physics.
INFRARED WORKING GROUP Annual Report, 1969–1970 [GROUPE INFRAROUGE Rapport d'Activite 1969–1970]
[1971] 22 p refs In FRENCH
Avail: NTIS

Progress at the infrared group of the Paris Observatory in the year 1969/70 is reviewed. Projects summarized include detectors, measurement of cosmic radiation, solar far infrared, spectrophotometry, interstellar gases, Josephson spectrometry and infrared observation of the galaxy. ESRO

N71-27638*# Bellcomm, Inc., Washington, D.C.
ON DETERMINING THE MOON'S DENSITY FUNCTION
S. L. Levie, Jr. 25 May 1971 12 p refs
(Contract NASw-417)
(NASA-CR-118892; B71-05025) Avail: NTIS CSCL 03B

A qualitative study is presented of the relations between the moon's density function, figure, external gravitational potential, and physical libration constants. It gives an assessment of the consistency of present libration and gravitational information, concluding that the consistency is poor. It is suggested that the moon's density function will be accessible theoretically when the figure and the gravitational potential are known with confidence. Author

N71-27669# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
PLASMA PHYSICS, SPACE RESEARCH, AND THE ORIGIN OF THE SOLAR SYSTEM
Hannes Alfven 1970 19 p
(Rept-70-39) Avail: NTIS

Scientific aims of space research, plasma physics and its applications, and the origin of the solar system are reviewed. The importance of hetegonic processes is emphasized. Future space missions are suggested. ESRO

N71-27764*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ORIENTATION AND RESONANCE LOCKS FOR SATELLITES IN THE ELLIPTIC ORBIT
Han-Shou Liu Apr. 1971 10 p refs Submitted for publication
(NASA-TM-X-65555; X-554-71-180) Avail: NTIS CSCL 22A

In order to achieve the maximum strength of higher rotational locks for satellites in the elliptic orbits, the condition of satellite orientation during the process of deployment is established. The result of this analysis is also applicable to the calculation of insolation on the surface of the planet Mercury. Author

N71-27870*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE PRODUCTION RATE OF AL 26 FROM TARGET ELEMENTS IN THE BRUDERHEIM CHONDRITE
Philip J. Cressy, Jr. Jun. 1971 21 p refs
(NASA-TM-X-65578; X-641-71-230) Avail: NTIS CSCL 03B

An 840-gram specimen of the Bruderheim chondrite was subjected to magnetic and heavy liquid mineral separation procedures, resulting in a number of chemically distinct samples. The samples were analyzed for cosmogenic Al-26 by nondestructive gamma-gamma coincidence counting. The observed Al-26 specific activities were correlated with the chemical composition of potential target elements by a weighted least squares fitting technique. The calculated Al-26 production rates, in dpm per gram of target element, are: Al, 1.09 + or − 0.17; Si, 0.270 + or − 0.009; S, 0.142 + or − 0.015. Production rates from Mg, Ca and NiFe were assumed to be 0, 0, and 0.0022 dpm per gram, respectively. Author

N71-27871*# National Aeronautics and Space Administration, Washington, D.C.
ANALYSIS OF APOLLO 10 PHOTOGRAPHY AND VISUAL OBSERVATIONS
1971 231 p refs
(NASA-SP-232) Avail: NTIS; SOD $4.25 CSCL 03B

Visual and astronomical observations from the Apollo 10 flight are described including surface textures of mare and highland areas, far-side basins, craters, sinuous rills, and volcanic terrain. Initial photographic analyses of lunar geology, craters, and volcanic features are presented. The photometry, photogrammetry, and photographs of the Apollo landing site 3 are also discussed. J.M.

N71-27872*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TESSERAL RESONANCE ON IMP-4 ORBIT
B. E. Lowrey Mar. 1971 14 p refs
(NASA-TM-X-65561; X-554-71-198) Avail: NTIS CSCL 22A

The IMP 4 orbit (Explorer 34) has a resonant perturbation on the time of perigee passage due to the third harmonic of the earth's gravitational field. The amplitude of the perturbation is 9 minutes, and the period is about 240 days. It appears that the effect can provide a significant test of the current values of the tesseral harmonics of third order. Other highly eccentric orbits may be expected to demonstrate this effect. Author

N71-27911*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK, VOLUME 3 Progress Report, Mar. – Apr. 1971
15 Jun. 1971 264 p refs
(Contract NAS7-100)
(NASA-CR-118895; JPL-TR-32-1526-Vol-3) Avail: NTIS CSCL 22A

The objectives, functions, and organization of the Deep Space Network (DSN) are summarized. Descriptions of the Pioneer F and G spacecraft telecommunications and antenna subsystems, Helios trajectories, DSN configuration for Mariner Mars 1971, Viking telecommunication system design, and radio science experiments are given. Tracking and navigational accuracy analyses and communications systems and elements research is summarized. Development and implementation of equipment by the Space Flight Operations, Ground Communication, and Deep Space Instrument Facilities are outlined. J.M.

N71-27949*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEARCH FOR MICROWAVE H2O EMISSION IN COMET BENNETT (1969i)
T. A. Clark, B. Donn, W. M. Jackson, W. T. Sullivan, III (NRL, Washington, D.C.) and N. Vandenberg (Md. Univ., College Park) May 1971 12 p refs Submitted for publication
(NASA-TM-X-65556; X-693-71-183) Avail: NTIS CSCL 03B

The 85-foot radio telescope of the Naval Research Laboratory was used in an attempt to detect the 22.235 MHz transition (6 sub 16 approaches 5 sub 23) of H2O during the recent appearance of Comet Bennett (1969i). No H2O emission of antenna temperature greater than 2.5 K was observed. Upper limits to the H2O column density for various temperatures of the cometary gas were derived. These limits have been compared with H2O column densities calculated from two different cometary models. It was found that on one of these models, the sensitivity was just at the threshold for detection of H2O. Author

N71-27975*# Allied Research Associates, Inc., Concord, Mass.
DEVELOPMENT OF A GLOBAL CLOUD MODEL FOR SIMULATING EARTH VIEWING SPACE MISSIONS
James R. Greaves, David B. Spiegler, and James H. Willand Apr. 1971 141 p refs
(Contract NAS8-25812)
(NASA-CR-61345; Rept-9G78-F) Avail: NTIS CSCL 22A

This study was made to improve and expand the existing cloud model and to add to the model other statistical data of importance to electromagnetic energy propagation through the atmosphere. An intensive data extraction procedure was carried out for six of the original 29 regions. Using simultaneous cloud-amount observations, a relationship was developed between ground and satellite-derived cloud frequency distributions. This relationship was used to introduce internal consistency between the unconditional and conditional statistics and between the temporal and spatial conditionals. As a byproduct of this procedure, the conditional data as listed in the Revised Data Bank are now stratified by month rather than by six-month seasons. A separate listing of the 1300 local-time unconditionals as modified to simulate a satellite-observed distribution was added to the data bank. The intensive data extraction procedure made possible the tabulation of temporal conditionals in 24-hour intervals from 24 hours to 240 hours, and the tabulation of spatial conditionals in 60-mile increments from 60 miles to 600 miles. Using these data, a Markov scaling technique was developed to scale the 24-hour and 200-mile conditional arrays to any other time or distance scale. The new data extraction procedure also made possible an evaluation of the cloud-amount homogeneity of the six selected regions. A new area enlarge procedure was developed which carries out a repetitive doubling of the representative area size for both the conditional and unconditional arrays. Some preliminary indications were made of how varying spatial resolutions would affect the simulation results. Recommendations are made as to the types of cloud data which are now required to extend the simulation results to other types of sensors such as infrared and microwave radiometers and to other spatial resolutions. Author

N71-27984*# New Mexico State Univ., Las Cruces.
MEASUREMENTS OF SATURN IN 1969
E. J. Reese May 1970 18 p refs
(Grant NGL-32-003-001)
(NASA-CR-118864; TN-701-70-33) Avail: NTIS CSCL 03A

Some recent measurements of Saturn and its rings are summarized. The results are based on measurements of good quality photographs with a Mann measuring machine. The photographic plates were exposed at the f:75 Cassegranian focus of the NMSU 61-cm reflector. Author

N71-27990# California Univ., Livermore. Lawrence Radiation Lab.
PRESSURE-VOLUME PROPERTIES OF TWO APOLLO 12 BASALTS
D. R. Stephens and E. M. Lilley 14 Dec. 1970 17 p refs Presented at the 2nd Ann. Lunar Sci. Conf., Houston, Tex., 11–14 Jan. 1971 Sponsored by AEC
(UCRL-72851; CONF-710102-2) Avail: NTIS

Two porous basalts from Apollo 12 were studied under hydrostatic pressure to 10 kbar in a fluid pressure medium and to 40 kbar in a quasihydrostatic medium. Compressibilities by the two methods were in excellent agreement. The compressibilities of the Apollo 12 rocks were qualitatively similar to that of Apollo 11 basalts; volume compressibilities were very high initially and decreased very rapidly with pressure to about 6-7 kbar, followed by a more gradual decrease. Porosity persists to high pressures in the Apollo 12 basalts in an analogous manner to the Apollo 11 samples. Volume changes with pressure were less for the Apollo 12 rock than for the Apollo 11 rocks. Author (NSA)

N71-28000*# Northrop Corp., Huntsville, Ala. Electro-Mechanical Div.
THEORY OF HIGHER ORDER OPTIMUM IMPULSIVE SOLUTIONS
J. F. Andrus Washington NASA May 1971 114 p refs
(Contract NAS8-20082)
(NASA-CR-1847; M-173) Avail: NTIS CSCL 22A

A theoretical discussion is presented of impulsive approximations to optimum solutions to space flight problems with bang-bang thrust magnitude control. With a few exceptions (such as constant thrust intercept problems), the theory is limited to exoatmospheric, multiburn problems in which the

thrust magnitude is a constant on each thrust arc and in which the coast arcs are of relatively long duration. Moreover, the theory of impulsive solutions is extended to include linear and higher order corrections to impulsive solutions. Analytical methods for optimization and guidance are the end result. The detailed development stops after the second-order corrections. The higher order corrections, although probably too complicated for practical use, can be derived in an analogous manner. The theory is applied to rendezvous and intercept problems. Concise expressions for first order corrections to the impulsive solutions to the latter problems are derived, and two numerical applications are made in which the errors in the impulsive approximations are reduced by an order of magnitude. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N71-26810*# Louisiana State Univ., Baton Rouge. Mechanical, Aerospace and Industrial Engineering Dept.
GRADUATE ENGINEERING PRACTICE IN MECHANICAL ENGINEERING. PART 3: SPACE SHUTTLE SEPARATION METHODS Final Report
Jerry Rubli 17 Apr. 1971 97 p refs
(Contract NAS9-10464)
(NASA-CR-115042) Avail: NTIS CSCL 22B

The analysis of the weight for four space shuttle separational methods is presented. The computer program listing and results, which prove that it is feasible to design a pyrotechnic ram are enclosed. Finally, the energy versus weight curves for the four different techniques studied are presented. Author

N71-26818# RAND Corp., Santa Monica, Calif.
BOOST ON LINE COMPUTER PROGRAM FOR ESTIMATING POWERED ROCKET PERFORMANCE
D. C. Kephart Feb. 1971 59 p refs
(Contract F44620-67-C-0045)
(AD-721189; R-670-PR) Avail: NTIS CSCL 9/2

The document discusses the users manual and program listing for BOOST, a quick-response, interactive JOSS program that simulates the powered flight performance of multistage booster rockets. BOOST is tailored for minimum make-ready and fast turnaround to aid planners and analysts in synthesizing new rocket configurations and in exploring variants on existing designs. BOOST flies a zero-lift two-dimensional powered trajectory over a spherical nonrotating earth. Coasting stages, earth rotation effects, and postboost vacuum ballistic trajectory associated with any set of rocket burnout conditions are available as options. Velocity losses due to gravity, aerodynamic drag, and atmosphere/nozzle interaction are considered. The rocket may be earth- or platform-launched into space, the atmosphere, or to the surface. BOOST complements rather than supplants the more detailed Fortran ROCKET program (RM-3524). Appendixes include a summary chart of the JOSS language. Author (GRA)

N71-26831*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ABSOLUTE STABILITY ANALYSIS OF ATTITUDE CONTROL SYSTEMS FOR LARGE BOOSTERS
S. M. Seltzer and D. D. Siljak (Santa Clara Univ., Calif.) 2 Apr. 1971 20 p refs
(NASA-TM-X-64582) Avail: NTIS CSCL 21H

A method for performing an absolute stability analysis of attitude control systems for large launch vehicles is presented. Absolute stability of these systems is shown to be of a limited extent. The regions of absolute stability are computed by using a quadratic Liapunov function. The function is chosen to provide additional information about the exponential property of absolute stability. A system model is used to illustrate the method. Author

N71-27032# Royal Observatory, Edinburgh (Scotland).
STOPWATCH OBSERVATIONS OF SATELLITES, NOVEMBER 1970
R. D. Eberst 27 Jan. 1971 26 p
(ROE-STS-108) Avail: NTIS

Stopwatch observations made at stations connected with the section during November 1970 are listed in launch and time order. For each satellite various subtotals are given. ESRO

N71-27108# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
BIOLOGICAL EXPERIMENT MODULE: FEASIBILITY STUDY
N. M. Hennen, G. Barthel, E. Bauer, H. Benninger, H. Heinze et al Oct. 1970 438 p refs
(Contract ESTEC-1034/70/HP)
Avail: NTIS HC $6.00/MF $0.95

A feasibility study of a biological experiment module to be attached to a multidisciplinary space station is described. In addition to the study definitions, the requirements and constraints, payload, configuration and structure, life support systems, propulsion system, and cost estimates are detailed. ESRO

N71-27152# British Aircraft Corp. (Operating) Ltd., Bristol (England).
DUAL-SPIN STABILITY STUDY Final Report
M. Brewer, R. Bushell, J. A. Holt, and N. Swift Sep. 1970 227 p refs
(Contract ESTEC-900/70/SL)
(ESS/SS-52) Avail: NTIS

The study involved theoretical analysis of the mutation damping stability of a dual-spin stabilization system and the derivation of criteria for the stability of both controlled and uncontrolled platform despin cases. The analysis shows that for the case of prime interest in which the platform is despun to a near-zero rate a sufficiently powerful platform mounted passive damper will interact with the despin control motor to give stability regardless of the inertial properties of the spacecraft with the exception that the rotor spin axis is also a nominal principal axis. The study also included simulation work as both a back-up to the theoretical analysis and as a means of investigating parametrically the properties of a dual-spin system and the influence of errors and defects likely to be found in practice. The comparison between theoretical and simulation results has proved to be satisfactory so that considerable confidence in the validity of the work and in the dual-spin concept has resulted. Author (ESRO)

N71-27330# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ALGORITHM FOR OPTIMAL FLIGHT VEHICLE DESIGN [ALGORITM OPTIMALNOGO PROEKTIROVANIYA LETATELNOGO APPARATA]
E. V. Tarasov 11 Jan. 1971 408 p refs Transl. into ENGLISH from the Russian
(AD-720915; FTD-HC-23-891-70) Avail: NTIS HC $6.00/MF $0.95 CSCL 16/4

The book discusses algorithmic methods of planning of flight vehicles using electronic digital computers. One such method of optimal planning is developed and investigated, including a presentation of the variational problem (strict mathematical definition of the required conditions of optimization) considering analysis of the flight vehicle as a structure which receives various loads in

flight, and as an object of control, plus an algorithm for its solution with a mathematical foundation for the algorithm itself. A multistage flight vehicle is used as an example to show the peculiarities of this algorithm when independent maneuver of the vehicle is possible after separation of initial stages or when the external and internal problems are analyzed together during interplanetary flights. In the algorithm, the criterion for improvement of the vehicle depends on the flight time, kinematic parameters of the vehicle at the end of the flight, its launch weight and the payload which it transports. Combining the theory of the variational problem and of the computer algorithm for its solution provides one with a logically complete atimal Flight Vehicle Design--Translation. GRA

N71-27653# Royal Observatory, Edinburgh (Scotland).
STOPWATCH OBSERVATIONS OF SATELLITES, OCTOBER 1970
R. D. Eberst 10 Dec. 1970 29 p
(ROE-STS-107) Avail: NTIS

Stopwatch observations made at stations connected with the section during October 1970 are listed in launch and time order. For each statement various subtotals are given. ESRO

N71-27680*# North American Rockwell Corp., Downey, Calif. Space Div.
NUCLEAR FLIGHT SYSTEM DEFINITION STUDY, PHASE 3. VOLUME 5: SCHEDULES, MILESTONES AND NETWORKS Final Report
W. G. Antypas Apr. 1971 75 p refs
(Contract NAS8-24975)
(NASA-CR-103147; SD-71-466-7) Avail: NTIS CSCL 22B

The individual schedules covering SR and T, test, manufacturing, and facilities' activities as well as alternate integrated program schedules are presented. Logic networks were prepared covering the essential elements of the phases, showing tasks, sequencing, and interfaces. Author

N71-27804*# Lockheed Missiles and Space Co., Huntsville, Ala.
SPACE SHUTTLE COMPARTMENT VENTING Final Report
S. J. Robertson and Juergen Haukohl Mar. 1971 23 p refs
(Contract NAS8-26464)
(NASA-CR-118869; HREC-6464-1; LMSC-HREC-D162796) Avail: NTIS CSCL 22B

A study was conducted to investigate and define the problems associated with the in-flight venting of space shuttle vehicles. A delta wing booster and high crossrange orbiter vehicles were selected as being representative of current space shuttle vehicle configurations. Compartmental-type areas within these vehicle configurations were identified as being likely to require venting. A preliminary venting analysis indicated that the more severe pressure stresses on compartment walls will occur during ascent. Special provisions for venting during descent, therefore, do not appear to be required. Author

N71-27950*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EXTREME DENSITY PROFILES FOR SKYLAB COMMAND MODULE ENTRY CONSIDERATIONS
David E. Pitts May 1971 18 p refs
(NASA-TM-X-58060) Avail: NTIS CSCL 22B

Two model atmospheres are presented: 3sigma density envelopes for 30 N latitude for January and July for use in entry studies of the Skylab command module entry. The two model atmosphere studies are to be used in calculation of entry corridor lines, calculation of entry monitoring system tolerances, and calculation of guidance and navigation system dispersion angles. Author

N71-27960*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
NUCLEAR SHUTTLE SYSTEM DEFINITION STUDY. VOLUME 1: EXECUTIVE SUMMARY, PHASE 3 Final Report
May 1971 52 p
(Contract NAS8-24714)
(NASA-CR-103175; MDC-G2134-Vol-1) Avail: NTIS CSCL 22B

The results are presented of a study aimed at the definition of two reusable nuclear stage concepts. The first concept is characterized as a 33 ft diameter configuration that is launched to orbit by a Saturn 5 INT-21 vehicle. The second concept is characterized as a modular configuration which is assembled in earth orbit from modules carried to orbit in the space shuttle. The objectives of the study are outlined and their relationships to other NASA efforts discussed. A description is given of the method of approach and the principal assumptions involved. Basic data generated in the study are presented and their significance is evaluated. D.L.G.

N71-27961*+ McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
NUCLEAR SHUTTLE SYSTEM DEFINITION STUDY. VOLUME 6: RELIABILITY AND SAFETY ANALYSIS, PHASE 3 Final Report, 1 May 1970 – 1 May 1971
May 1971 434 p
(Contract NAS8-24714)
(NASA-CR-103177; MDC-G2134-Vol-6) Avail: NTIS HC $8.00/MF $0.95 CSCL 22B

The reliability analysis investigated every failure mode of every component of major subsystems, except structures, on the reusable nuclear stage (RNS) system to determine the effect of a failure. The items that could cause loss of the RNS were identified as flight critical items and were quantified in a single failure analysis. These items were then ranked in order of decreasing criticalities, and a reliability prediction of the RNS was made. The safety analysis extended this reliability analysis by an investigation of the flight critical items and definition of a series of recommendations for elimination of the flight critical status, or reduction in its probability of occurrence. Multiple failures were investigated in a top-down fault tree analysis. An abort analysis was performed to determine the operational problems caused by failures during the mission. The abort analysis and the failures were then combined to produce a contingency plan, i.e., a plan of action to follow if a failure occurs. The contingency planning work sheets, fault trees, abort analysis, and contingency plan comprising the total safety analysis effort are presented. Author

N71-27962*+ McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
NUCLEAR SHUTTLE SYSTEM DEFINITION STUDY. VOLUME 7: RNS PROJECT REQUIREMENTS, PHASE 3 Final Report
May 1971 246 p refs
(Contract NAS8-24714)
(NASA-CR-103178; MDC-G2134-Vol-7) Avail: NTIS CSCL 22B

Working data are presented from the functional analysis and operations analysis activities conducted on the reusable nuclear stage concepts. All other programmatic information affecting the nuclear shuttle is contained including descriptions of missions, operations, safety, reliability, and maintainability. The working data are offered in three separate sections that include: (1) project integration data, (2) project support and interface requirements, and (3) system engineering documentation. D.L.G.

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N71-26932*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FAILURE DETECTION OF A SPACE SHUTTLE WING FLUTTER MODEL BY RANDOM DECREMENT

Henry A. Cole, Jr. May 1971 9 p refs

(NASA-TM-X-62041) Avail: NTIS CSCL 22B

C random decrement method for obtaining on-the-line characteristic signatures of a structure while operating in its natural environment is explained. The method is then applied to the buffet-flutter random response of a space shuttle wing model which was tested to destruction. Signature changes obtained from a high frequency band-limited signal 50 seconds prior to the final failure were of sufficient magnitude to be of use in a failure detection system. Author

N71-26946# Brown Univ., Providence, R.I. Div. of Engineering.

A LAGRANGIAN FORMULATION FOR LARGE ELASTIC DEFORMATIONS OF THIN SHELLS

Georges A. Dupuis Feb. 1971 38 p refs

(Contract N00014-67-A-0191-0008)

(AD-721256; N00014-0008/2; TR-2) Avail: NTIS CSCL 20/11

The report presents a Lagrangian formulation for large elastic deformations of thin shells, particularly suitable for finite element analysis. A variational principle involving the rate of displacement is obtained. This principle is the starting point of an incremental analysis. The displacement field is integrated with respect to time by Eulers method and, for each step, a quadratic variational problem has to be solved. Author (GRA)

N71-27238# Argonne National Lab., Ill. Engineering and Technology Div.

LOAD EQUIVALENCE PARAMETERS FOR DYNAMIC LOADING OF STRUCTURES IN THE PLASTIC RANGE

Carl K. Youngdahl May 1970 71 p refs

(Contract W-31-109-eng-38)

(ANL-7677) Avail: NTIS

The solutions to four classical problems in dynamic plasticity; circular plate under uniform pressure, the reinforced circular cylindrical shell under uniform pressure, the free-free beam with a central concentrated force, and the circular cylindrical shell with a ring load are examined to determine the effect of pulse shape on final plastic deformation. It is found that there is a strong dependence on pulse shape for pulses having the same total impulse and maximum load; however, the effect of the pulse shape is virtually eliminated if the pulses have the same total impulse and effective load. The effective load is defined as the impulse divided by twice the mean time of the pulse, where the mean time is the interval between the onset of plastic deformation and the centroid of the pulse. Author (NSA)

N71-27274# Brown Univ., Providence, R.I. Div. of Engineering.

THREE DIMENSIONAL ELASTIC-PLASTIC STRESS AND STRAIN ANALYSIS FOR FRACTURE MECHANICS. PHASE 1: SIMPLE FLAWED SPECIMENS

N. Levy and P. V. Marcal Sep. 1970 121 p refs Prepared for ORNL

(Contract W-7405-eng-26)

(HSSTP-TR-12) Avail: NTIS

Development of an elastic-plastic finite element analysis for three-dimensional specimens with flaws is described. Particular attention is paid to the analysis of a semielliptic crack and a through crack in a plate of finite thickness. Elements developed include the three-dimensional polar, the cubic, and the cubic distorted. In addition, programs to generate the mesh of elements and nodal points for a given problem size and specimen geometry have been written and tested. The finite element analysis is implemented by a computer program developed so as to handle problems with up to 10,000 degrees of freedom. As is well known, such large problems are frequently encountered in three-dimensional analysis. This capability is also required for the analysis of the stress and strain field near cracks. Results of analysis for a through crack with 4500 degrees of freedom, and for a semielliptic crack with 2700 degrees of freedom are shown. Author (NSA)

N71-27284# Alabama Univ., Huntsville. Dept. of Engineering and Mechanics.

THERMOMECHANICAL DISSIPATION ANALYSIS OF THERMOVISCOELASTIC SOLIDS BY FINITE ELEMENTS

Thomas L. Coet and James L. Hill 11 Mar. 1971 34 p refs

(Contract F44620-69-C-0124)

(AD-720887; AFOSR-TR-71-0614) Avail: NTIS CSCL 20/11

The thermomechanical dissipation function for thermorheologically simple materials, which is derivable from a rational theory of thermodynamics, is examined for the special case of oscillatory motion. It is demonstrated that in most practical applications the dissipation function can be adequately represented by the expression for the total work. Dissipation effects in thermoviscoelastic materials are discussed. A solution to a boundary value problem involving twisting of a solid circular cylinder of viscoelastic material with temperature dependent material properties is obtained by use of the finite element method. Two dimensional heat transfer is permitted. The theoretical results are compared with experimental measurements of the temperature in a solid polyurethane cylinder being twisted in an oscillatory manner. The comparisons indicate that isothermal dissipation theory overestimates the amount of heat generated while the thermorheologically simple theory underestimates the heat generated. In the frequency range of 100-1000 cpm and at small strains, temperature changes of about 30F were recorded. Author (GRA)

N71-27383# Franklin Inst., Philadelphia, Pa. Research Labs.

CRITICAL THOUGHTS ON STRUCTURAL MECHANICS AND NDE

Melvin B. Zisfein and William B. Tarpley 9 Sep. 1971 36 p refs Presented at the Symp. on Adv. Exptl. Tech. in the Mech. of Mater., San Antonio, 9-11 Sep. 1970

(Contract F44620-68-C-0068)

(AD-720899; C-2231; AFOSR-70-2870TR) Avail: NTIS CSCL 14/2

A critical review of non-destructive evaluation (NDE) is given in general terms and specific examples of NDE techniques are given. These employ radiography (X-ray and neutron), ultrasonics, penetrants, eddy currents, thermography, laser interferometry and holography. Other techniques not discussed in detail include magnetics, Mossbauer spectra, and spin resonance. The state-of-the-art is presently technique-oriented, rather than problem oriented due, in part, to ineffective communication links between designer, NDE researcher and user. Problems areas are identified which include better data handling and interpretive techniques for the user as well as detectability and resolution criteria; and certain materials problems (e.g., limited ductility materials); and an especially urgent need is expressed for control indices for surface contamination by NDE. Methods are suggested for improving the communications link and the idea of analogue acceptability or evaluation is stressed in favor of binary go:no-go type decisions. In this way the NDE techniques would enjoy more user acceptance as well as utility. Author (GRA)

N71-27570# Watervliet Arsenal, N.Y.

BUCKLING ANALYSIS OF A RECTANGULAR PLATE BY THE KANTOROVICH METHOD

Peter C. T. Chen Jan. 1971 29 p refs

(AD-720890; WVT-7103) Avail: NTIS CSCL 20/11

The Kantorovich method is applied to the elastic and plastic buckling problems of a rectangular plate. Stowells theory of plastic buckling is adopted and the general method of solution is presented. The illustrated examples considered here are a class of uniformly compressed rectangular plates that are claped and free

along two unloaded sides and having various edge conditions along the loaded sides. Simple approximate formulae are derived for calculation of the buckling load in both elastic and plastic ranges. Some numerical results, together with discussions, are given. It seems that this method, apart from its simplicity and generality, gives also very accurate results for engineering problems. Author (GRA)

N71-27805# Illinois Inst. of Tech., Chicago.
CYCLIC FATIGUE OF BRITTLE MATERIALS Progress Report
L. J. Broutman and S. K. Gaggar 30 Jan. 1971 27 p Sponsored by AEC
(COO-1794-7) Avail: NTIS

The flexural fatigue characteristics of epoxy (Epon 828) and polyester (Paraplex P43) resins are investigated. A rotating beam fatigue machine which maintains a constant stress and a plate bending fatigue machine which maintains a constant displacement were both used for this project. These methods provide a zero mean stress with alternating tension and compression stresses. The effect of cyclic frequency was determined as well as the effect of the environment, particularly, the role of water vapor. Temperature rise during fatigue testing is measured using an infrared radiation thermometer which does not contact the specimen. The strength, modulus, and hysteresis are then studied as a function of temperature to determine how the temperature rise during fatigue will influence the ultimate failure. Fracture surfaces are studied by optical, interference, and electron microscopy to relate the crack growth to the fatigue experiment. Author

N71-27806# Aeronautical Research Labs., Melbourne (Australia).
A REVIEW OF SOME CUMULATIVE DAMAGE THEORIES
M. J. O'Neill Jun. 1970 73 p refs
(ARL/SM-326) Avail: NTIS

A number of cumulative damage theories are reviewed that relate to service life of structures under fatigue loading. The accuracy of prediction, data requirements, and ease of computations are compared. There is no evidence that any of the more complex theories are superior to the linear rule in situations of practical interest and all require more data and additional calculations. Author

N71-27854# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
DIMENSIONAL INSTABILITY: AN INTRODUCTION
R. E. Maringer Apr. 1971 20 p refs
(Contract F33615-71-C-1067)
(AD-721198; DMIC-MEMO-253) Avail: NTIS CSCL 20/11

The point of the memorandum is to emphasize the danger in accepting engineering data at face value. The definition of units used in the measurement of engineering parameters related to solid materials is discussed. A major portion of the memorandum is concerned with micromechanical strength parameters in solids such as yield strength, elastic limit, and proportional limit. Variation of elastic constants in ordinary engineering materials under various conditions is discussed. A final section of the memorandum discusses variation of the thermal expansion coefficient in materials. Author (GRA)

N71-27856# Aeronautical Research Labs., Melbourne (Australia).
ROTATIONAL STRESSES AND DEFLECTIONS IN A SHALLOW SPHERICAL SHELL. PART 1: LINEAR ANALYTIC SOLUTION
N. S. Swansson Jul. 1970 21 p refs
(ARL/ME-318) Avail: NTIS

The system of stress and strain equations for a rotating shallow spherical shell is outlined, and the solution for the linear (small deflection) problem is developed, including detailed expressions for stress and deflection values. Results are presented for selected shell configurations. The simple ratio of shell height to thickness governs the form of the resulting solution. At extreme values of this ratio the solution approaches either the flat disc or the membrane shell solution. When height and thickness are of the same order, high bending stresses occur and the complete shell solution must be used. The limits of linear behaviour are indicated and a parameter governing nonlinear effects is given. Author

N71-27857# Aeronautical Research Labs., Melbourne (Australia).
STRESS WAVE EMISSION (SWE)
I. G. Scott Sep. 1970 19 p refs
(ARL/Met-72) Avail: NTIS

The nature of recorded stress wave emission was examined in terms of frequency, pulse amplitude and count rate. Frequency and pulse amplitude were found to be strongly affected by instrumentation methods, whilst wave shape and count rate were dependent on the mode of, and proximity to, specimen failure. A partly successful attempt was made to identifiy, in general terms, the sources of SWE, by examining experimental results from a number of workers. Author

N71-27858# California Univ., Livermore. Lawrence Radiation Lab.
IDENTIFICATION OF DYNAMIC SYSTEMS FROM EXPERIMENTAL DATA
David F. Hillyer 15 Nov. 1970 68 p refs Presented at Exptl. Stress Analysis Meeting, Salt Lake City, 18 May 1971 Sponsored by AEC
(UCRL-72818; CONF-710502-1) Avail: NTIS

Laboratory vibration tests were performed to provide the experimental data for an analytical modal path model of a structural system. With modal path numerical parameters, a lumped-mass model of the system was constructed. Author

N71-27859# Army Materials and Mechanics Research Center, Watertown, Mass.
STABILITY OF TRANSIENT SOLUTION OF MODERATELY THICK PLATE BY FINITE DIFFERENCE METHOD
Tien Yu Tsui and Pin Tong Dec. 1970 13 p refs
(AD-721001; AMMRC-TR-70-34) Avail: NTIS CSCL 20/11

The condition of stability of the finite-difference equation for the transient response of a moderately thick plate is derived. The effect of transverse shear and rotatory inertia on the stability condition a a moderately thick plate requires a much smaller time increment than the corresponding one for a thin plate in order to insure numerical stability. It is found that when either the effect of transverse shear or rotatory inertia is included, the sufficient stability condition is identical to that for the thin plate. Author (GRA)

N71-27860# Ohio Northern Univ., Ada.
A STUDY OF THE HYDROELASTIC VIBRATIONS OF SPRING SUPPORTED CYLINDERS IN A STEADY FLUID STREAM DUE TO VORTEX SHEDDING Final Report, Feb. 1969 – Aug. 1970
Robert J. Glass Nov. 1970 64 p refs
(Contract N00014-69-C-0148)
(AD-721073) Avail: NTIS CSCL 20/11

The steady state amplitude and frequency response for the vortex-induced transverse vibrations of a circular cylinder mounted on linear springs in a steady fluid stream was considered. The tests were conducted in water and the range of variations were: aspect ratio 16.5 to 29.9; the ratio of cylinder density to fluid density 0.718 to 8.67; Reynolds number: 1727 to 4317. The nondimensional frequency response was found to be a strong function of the cylinder-to-fluid density ratio. The nondimensional frequency response was found to be a strong function of the cylinder-to-fluid density ratio. The nondimensional amplitude response was found to be a function of cylinder-to-fluid density ratio, Reynolds number, and the dimensionless ratio of the free stream velocity divided by the

product of natural frequency and cylinder diameter. The maximum nondimensional amplitude response was analyzed for the form of dependency and empirical equations were developed. Author (GRA)

N71-27861 California Univ., Los Angeles.
INELASTIC BUCKLING OF THIN SPHERICAL SHELLS UNDER POINT LOADS AT THE APEX
Stephen Shou-Kang Wang (Ph.D. Thesis) 1969 130 p
Avail: Univ. Microfilms Order No. 70-12022

The influence of inelastic strains on the deformation and stability of thin spherical domes under point loads at the apex is investigated both analytically and experimentally. The results indicate the following: (1) inelastic strain effects do account for most of the discrepancies existing between the theoretical predictions and the experimentally obtained shell responses; (2) reduction in the effective stress does occur in the outer layers at the ridge of the deformation dimple as it spreads outwardly during the loading process; and (3) the stress-strain relation of the dome material has a definitive effect on the response of the dome. Dissert. Abstr.

N71-27865# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PLOTTING DIAGRAMS OF ULTIMATE STRESSES FOR BRITTLE BODIES WITH POINTED CONCENTRATIONS
V. V. Panasyuk et al 28 Dec. 1970 10 p refs Transl. into ENGLISH from Akad. Nauk. Ukr. RSR, Ser. A: Fiz.-Tekh. Ta Matematichni Nauk. (Kiev), v. 31, 1969 p 1021–1025
(AD-720939; FTD-HC-23-677-70) Avail: NTIS CSCL 20/12

The report examines a planar problem for a brittle body weakened by pointed (with reset points) stress concentrators. Author (GRA)

N71-27945*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CREEP FATIGUE ANALYSIS BY STRAIN-RANGE PARTITIONING
S. S. Manson, G. R. Halford, and M. H. Hirschberg [1971] 30 p refs Presented at 1st Nat. Pressure Vessel and Piping Conf., San Francisco, 10–12 May 1971; sponsored by ASME
(NASA-TM-X-67838) Avail: NTIS CSCL 20K

Strain-range analysis of creep-fatigue behavior of metals is partitioned into the following components: tensile plastic flow reversed by compressive plastic flow, tensile plastic flow reversed by compressive creep, or tensile creep reversed by compressive plastic flow, and tensile creep reversed by compressive creep. These strain-range components are then related independently to cyclic life by equations. A linear life fraction rule is used to sum the damage resulting from each of these strain-range components. Failure is assumed to occur when the summation of damage fractions equals unity. Test results are presented for 2 1/4Cr-1Mo steel as well as limited information for 316 stainless steel. The method is used for interpreting effects of frequency of strain cycling and strain hold times in both tension and compression. It also provides insight into the validity of the previously proposed 10 Percent Rule for creep-fatigue analysis. Author

N71-27986# Sandia Corp., Albuquerque, N.Mex. Exploratory Systems Dept. 1.
ON THE USE OF MODELING IN A STRUCTURAL RESPONSE PROBLEM
D. E. McGovern and S. Thunborg, Jr. Mar. 1971 17 p refs
(SC-RR-70-880) Avail: NTIS

A typical problem in the design of an air transportable weapon container is to establish its ability to withstand ground impacts resulting from aircraft crash or midair breakup. In such problems modeling theory can be used to reduce vehicle size, so that data can be obtained and interpreted with more ease and less expense. Validity of the application of modeling theory to this type of problem has been verified by the testing of sets of units differing in size by a factor of four. The test units were impacted on steel slabs at speeds from 80 to 600 ft/sec, and the resultant damage and dynamic impact responses were compared. Results show that modeling of impact response can be used to develop a full size design. Author (NSA)

N71-27989*# MacNeal-Schwendler Corp., Los Angeles, Calif.
STRUCTURAL DYNAMICS OF THE HELIOGYRO
Richard H. Mac Neal Washington NASA May 1971 107 p refs
(Contract NAS7-899)
(NASA-CR-1745; MS-73-1) Avail: NTIS CSCL 22B

The heliogyro is a particular form of the solar sail in which the reflecting surface consists of a set of long, narrow and very thin blades that rotate about a central axis in the manner of a helicopter rotor. Blade pitch is the primary means of control. The structural dynamics of the heliogyro are studied in order to provide a basis for engineering development and to answer questions regarding concept feasibility. The topics that are examined include vibration modes, damping, coupling between blade pitch and blade bending, and dynamic response to maneuver commands. The results of a brief experimental program are presented and compared with analysis. Author

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N71-26869*# Marshall Industries, Irvine, Calif.
COMBUSTION PROCESS OF IMPINGING HYPERGOLIC PROPELLANTS
L. B. Zung and J. R. White May 1971 39 p refs
(Contract NAS3-12031)
(NASA-CR-1704; SN-145-F) Avail: NTIS CSCL 21B

Single exposure photography and high speed motion pictures were used to study the sprays formed by impinging streams of liquid hydrazine and nitrogen tetroxide. Chamber pressures were varied between 15 psia and 500 psia. Four different orifices (.027 to .060 inches) were used. Propellant temperatures and velocities were varied from 40 F to 140 F and 15 ft/sec to 95 ft/sec, respectively. Influence of chamber pressure and propellant temperature on separation and mixing were determined. Effects of orifice diameter and chamber pressure on the occurrence of popping were quantitatively evaluated. Author

N71-26913*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESONANCE TUBE IGNITION OF HYDROGEN-OXYGEN MIXTURES
Bert R. Phillips and Albert J. Pavli Washington May 1971 33 p refs
(NASA-TN-D-6354; E-6122) Avail: NTIS CSCL 21B

A method was found to render the rocket engine igniter system independent of ambient pressures by enclosing the nozzle gap in a can. The effects of many variables were determined, resulting in an optimized configuration which could ignite a 70 F (294 K) hydrogen-oxygen mixture in 0.13 second with 35-psia (241-kN/sq m) propellant supply pressure. No ignitions were obtained with gases colder than −265 F (108 K). At −265 F (108 K), the ignition lag was 20 times greater than at 70 F (294 K) (10 sec as compared to 0.5 sec). Author

N71-26964# National Physical Lab., Teddington (England). Div. of Chemical Standards.

THERMODYNAMIC PROPERTIES OF ALKALI METAL ALLOYS

P. J. Spencer Mar. 1971 41 p refs

(NPL-DCS-10) Copyright. Avail: NTIS

Evaluations of the thermodynamic properties of a number of binary alkali metal systems are presented in periodic sequence. ESRO

N71-27015*# Boeing Co., Huntsville, Ala.

SATURN 5/SKYLAB MULTIPLE-PROTUBERANCE HEAT TRANSFER TEST DATA ANALYSIS

W. L. Shaffer, C. P. Williamson, and C. R. Mullen 19 May 1971 151 p refs

(Contract NAS8-5608)

(NASA-CR-61353) Avail: NTIS CSCL 20M

Multiple protuberance heat transfer data obtained from wind tunnel tests are presented. The primary purpose of the test series was to determine the heat transfer to bodies submerged in the wake of, or having their surface impinged upon by the shock or shocks of one or more protuberances. Protuberance models consisted of: (1) four models with a 15 or 30 degree forebody, constant cross-section center body and a 15-, 30-, or 90-degree afterbody, (2) a 14-degree ramp, and (3) four models of anti-flutter fat sections. The models were mounted on the tunnel sidewall test plate in singular and multiple configurations and heat transfer data recorded from thermocouples located on the test plate and models. Additionally, test plate pressures were obtained in the vicinity of the fat section models. Some limited comparisons of theoretical heat transfer and the test data have been made. Author

N71-27021# Argonne National Lab., Ill. Reactor Analysis and Safety Div.

VAPORIZATION DYNAMICS OF INITIALLY STATIC SUPERHEATED SODIUM

Ralph M. Singer and Robert E. Holtz Sep. 1970 34 p refs

(Contract W-31-109-eng-38)

(ANL-7706) Avail: NTIS

Measurements of the patterns of vapor growth resulting during the transient boiling of initially static, nonuniformly superheated sodium in a vertical channel are presented and discussed. It is demonstrated that the single-slug vapor-growth model (in which the entire channel cross section is filled with vapor, except for a thin liquid film on the walls) may not be valid when the liquid temperature gradient normal to the channel axis is large and asymmetric, and/or the incipient boiling superheat is small. Under certain conditions, void fractions as low as 0.3 to 0.5 were observed. When the incipient superheat is large, the predictions of a simple vapor-slug-growth model compare favorably with the measured results. Experimental data on the vapor growth and collapse rates and the associated pressure transients are presented for boiling pressures up to about 1 atm and superheats up to about 180 C. Author (NSA)

N71-27092# Iowa State Univ. of Science and Technology, Ames.

EFFECT OF RANDOM EXPERIMENTAL ERROR IN VAPOR-LIQUID EQUILIBRIUM DATA ON THERMODYNAMIC CONSISTENCY

Dean LeRoy Ulrichson (Ph.D. Thesis) Nov. 1970 150 p refs

(Contract W-7405-eng-82)

(IS-T-428) Avail: NTIS

Experimental vapor-liquid equilibrium data usually contain random error as result of the uncertainty associated with experimental measurements. The data may also contain nonrandom or systematic error caused by improper experimental procedure. A thermodynamic consistency test is proposed which permits statistical treatment of random error and thus systematic error is more easily identified. Simulated systems with imposed random error are used to illustrate and verify the procedures. The local integral consistency test is shown to be quite insensitive to measurement uncertainties in liquid composition. The uncertainty in the liquid composition is, however, frequently the major source of uncertainty in the activity coefficient and both the measurement uncertainties and consistency test results are required to adequately characterize vapor-liquid equilibrium data. Consistency tests which are applied to smoothed data or which force consistency by requiring deviations from the data are shown to be inferior to those tests which simply characterize the data. The proposed test procedure is rigorous and can be used to estimate the heat of mixing and volume change of mixing when these quantities are unknown. Author

N71-27107# Technische Hochschule Stuttgart (West Germany). Inst. fuer Kernenergetik.

STUDY OF APPLICATIONS OF HEAT PIPES TO TEMPERATURE CONTROL FOR EUROPEAN METEOROLOGICAL SATELLITE

Mar. 1971 53 p refs

(Contract ESTEC-1048/70-HP)

Avail: NTIS

Heat pipes for meteorological satellite temperature control are studied. Life tests were performed on stainless steel and copper heat pipes with acetone, ethyl and methyl alcohols as heat carriers. It is concluded that stationary and periodical tests should be carried out in order to study the corrosion mechanism, formation of gas buffers, and endurance limit of the welds. ESRO

N71-27163# Technische Hochschule Munchen (West Germany). Inst. A fuer Thermodynamik.

HEAT TRANSFER TO REFRIGERANTS AT NUCLEATE BOILING, FILM BOILING, AND SUPERCRITICAL CONDITION OF THE FLUID [WAERMEUEBERGANG AN KAELTEMITTEL BEI BLASENVERDAMPFUNG, FILMVERDAMPFUNG UND UEBERKRITISCHEM ZUSTAND DES FLUIDS]

H. Haffner Nov. 1970 142 p refs In GERMAN; ENGLISH summary

(BMBW-FBK-70-24) Avail: AEC Depository Libraries

In a natural circulation loop heat transfer from the inside of a vertical tube to the refrigerants R 12 and R 22 was studied. At reduced pressures p/p sub c from about 0.2 to 2.0, experiments with nucleate boiling, film boiling and supercritical condition of the fluid were carried out. The results are presented in diagrams and tables. The pressure dependence of heat transfer with nucleate boiling is generalized by a relative function; the influence of surface roughness is discussed by microphotographs. The pressure dependence and the deterioration by buoyancy forces of heat transfer with film boiling and supercritical condition of the fluid are discussed. Whereas, heat transfer with nucleate and film boiling is strongly improved with increasing pressure, heat transfer in the studied supercritical region is nearly pressure independent. Author (NSA)

N71-27394*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

REVIEW OF FACTORS AFFECTING IGNITION OF METALS IN HIGH PRESSURE OXYGEN SYSTEMS

J. H. Kimzey 28 Oct. 1970 25 p refs

(NASA-TM-X-67201; MSC-03461) Avail: NTIS CSCL 20M

As a result of the Apollo 13 supercritical oxygen tank incident, a literature survey was conducted to determine the availability of data concerning ignition of metals in liquid or high pressure oxygen environments. Brief summaries are provided of the reported data with emphasis being given to the effects of oxygen concentration; total pressure; convection, including zero gravity; oxygen percentage; and halogenated compounds on ignition. Author

N71-27862* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

POWER SYSTEM WITH HEAT PIPE LIQUID COOLANT LINES Patent

Ambrose W. Byrd, inventor (to NASA) Issued 20 Oct. 1970 7 p Filed 16 Feb. 1968 Cl. 310-4; Int. Cl. H01j45/00
(NASA-Case-MFS-14114; US-Patent-3,535,562; US-Patent-Appl-SN-706013) Avail: US Patent Office CSCL 20M

A power system having a number of thermionic diodes connected in parallel is reported. The diodes use heat pipes as cathodes. The system employs a circulatory cooling system utilizing liquid metal coolant lines which are heated by a series of heat pipes butted end-to-end and extending through the center of the lines. Official Gazette of the U.S. Patent Office

N71-27863*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HEAT TRANSFER FROM AN INCANDESCENT WIRE IN SATURATED LIQUID NITROGEN FROM ATMOSPHERIC TO THE CRITICAL PRESSURE

Kenneth J. Baumeister, S. Stephen Papell, and Robert W. Graham 1971 9 p refs Proposed for presentation at the Intern. Congr. of Refrig., Washington, D.C., 27 Aug.–3 Sep. 1971
(NASA-TM-X-67849; E-6354) Avail: NTIS CSCL 20M

Film boiling off horizontal platinum wires in saturated liquid nitrogen at 1 g has been examined at pressures up to 33 atmospheres and wire temperatures approaching the melting temperature of platinum. The experimental data are compared to existing correlations. It is shown that present film boiling correlations do not predict the correct trends for increasing wall to bulk temperatures. Author

N71-27864*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPARISON OF TWO AND THREE DIMENSIONAL STEADY STATE THERMAL ANALYSES OF A HEAT SOURCE CONSIDERED FOR ISOTOPE BRAYTON

Raymond K. Burns May 1971 54 p refs
(NASA-TM-X-67853; E-6358) Avail: NTIS CSCL 20M

Two and three dimensional thermal analyses have been performed to predict the internal temperatures in an isotope heat source during steady state operation with a Brayton power system. The heat source design considered is a slight modification of the Pioneer heat source and is referred to herein as IBHS. Two and three dimensional results are compared for a limited range of fuel loadings about the nominal 400 W value and for a range of capsule lengths. One approach consisted of estimating the effective fuel power density which was then input to the two dimensional models. The other approach consisted of using a small number of three dimensional solutions to develop expressions for effective fuel power density as a function of heat source length. Author

N71-27866*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.

FILM BOILING OF CRYOGENIC HYDROGEN DURING UPWARD AND DOWNWARD FLOW

S. S. Papell 1971 11 p refs Proposed for presentation at the Thirteenth Intern. Congr. of Refrig., Washington, D.C., 27 Aug.–3 Sep. 1971
(NASA-TM-X-67855; E-6360) Avail: NTIS CSCL 20M

The influence of buoyancy on a vertical flowing film boiling system was determined by comparison of upflow and downflow data under identical test conditions. Differences in the data were observed at two heat flux levels. At low heat fluxes, the transition from nucleate to film boiling occurred prematurely for downflow at heat fluxes that supported nucleate boiling for upflow. At high heat fluxes, the inlet side of the downflow test section operated at a significantly higher temperature than for upflow. This difference in heat transfer was correlated by modification of an existing film boiling equation. Author

N71-27867*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INTERFACIAL SHEAR FACTORS FOR LAMINAR FILM BOILING FROM A VERTICAL SURFACE

Kenneth J. Baumeister and Harold R. Jacobs [1971] 10 p refs Proposed for presentation at 13th Intern. Congr. of Refrig., Washington, D.C., 27 Aug.–3 Sep., 1971
(NASA-TM-X-67860) Avail: NTIS CSCL 20M

Forced flow film boiling heat transfer coefficients from a vertical surface have been expressed in terms of the interfacial shear or the so called slip at the liquid vapor interface. The heat transfer coefficient is expressed as a function of the Froude number and the shear factor. The shear factors are determined from an exact analysis which accounts for the coupling between the vapor and liquid momentum at the interface. The correlating equation is valid over a wide range of Froude numbers. Author

N71-27933# Oak Ridge National Lab., Tenn. Reactor Div.

ISOTOPE KILOWATT PROGRAM Quarterly Progress Report, Period Ending 31 Dec. 1970

Feb. 1971 26 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3292) Avail: NTIS

The organic fluid capsule test system was constructed, the test installation was completed, the system was brought up to temperature, and endurance testing was started at 600 F. The heat pipe and associated test equipment for the thermoelectric heat transfer test were fabricated, the test installation was completed, and the shakedown tests were initiated. Analyses of the relative performance characteristics of iron and nickel block-shield assemblies were completed. The study shows that nickel will be required if advanced thermoelectric materials become available and are to be operated with a hot junction temperature of 1350 F, but for the rest of the systems steel will be satisfactory. The 4.10-in. diameter fuel capsule for the $SrTiO_3$ source and a detailed report validating the capsule design with a safety analysis was prepared. Author (NSA)

N71-27987# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOME FEATURES OF THE DEVELOPMENT AND COMBUSTION OF A GAS JET IN THE CIRCULATION ZONE BEHIND A STABILIZER

V. A. Khristich et al 23 Jan. 1971 22 p refs Transl. into ENGLISH from Teoriya i Prakt. Szhiganiya Gaza, Tr. Nauchn. Tekhn. Soveshch. (Moscow), v. 3, 1967 p 283–295
(AD-721026; FTD-MT-24-314-70) Avail: NTIS

As a result of the conducted analysis the basic characteristics of development and burning of a gas jet in the turbulent wake behind a stabilizer are clarified and the working relationships which make it possible to estimate the length of the spray along a stabilizer and the conditions of the stability of its burning are obtained. On the basis of these data a procedure has been developed for the calculation and design of jet gas burners, making it possible to create gas burners which guarantee highly intensive and stable combustion of gas fuel over a wide range of loads and air surplus factors. Author (GRA)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N71-26802# Federal Aviation Administration, Washington, D.C.
TRANSPORTATION AND COMMUNITY VALUES
John H. Shaffer 16 Apr. 1971 38 p Conf. held at Warrenton, Va., Mar. 1969; sponsored by NAS-NRC
Avail: NTIS

An overview is presented of the problems of transportation as they relate to community values. The information contained is based on a study of the social problems associated with the construction of new surface transportation facilities. Since a large degree of commonality exists in the social implications and community involvement considerations for the construction of surface transportation facilities and those for air facilities, the material is applicable to, and in part oriented towards, the airport development problem. Two community airport cases are included as illustrations of successful community planning and local/Federal Government cooperation. D.L.G.

N71-26814# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE NATURE AND FEATURES OF THE SCIENTIFIC-TECHNICAL REVOLUTION
Yu. S. Meleshchenko 6 Jan. 1971 32 p refs Transl. into ENGLISH from Vopr. Filosofii (USSR), v. 22, no. 7, 1968 p 13–24
(AD-720916; FTD-MT-24-232-70) Avail: NTIS CSCL 5/3

Marxist social and material economic bases of the contemporary stage of scientific-technical revolution are examined. The increasing tempo of this revolution with developments in basic and information sciences is discussed in relation to their increasing complexity and the national importance of being able to deal effectively with them and the people involved. Author (GRA)

N71-27104# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
PROPOSAL FOR APPLICATION MIL-STD-781B, RELIABILITY TESTS - EXPONENTIAL DISTRIBUTION, FOR ELECTRONIC DEVICES [VORSCHLAG DER ANWENDUNG DES MIL-STD-781B, "RELIABILITY TESTS - EXPONENTIAL DISTRIBUTION, BEI ELEKTRONISCHEN GERAETEN]
Heinz Reitberger 1969 12 p refs In GERMAN Presented at the DGLR Symp. on Reliability and Test Efforts, Munich, 12 Jun. 1969
Avail: NTIS

The relationship between MTBF and costs is analyzed for German satellite space programs, taking into account the expenditure for testing in quality control. The evaluation of test results is described. ESRO

N71-27105# Technische Univ., Berlin (West Germany). Inst. fuer Raumfahrttechnik.
THE BENEFIT OF SPACE RESEARCH FROM THE GERMAN POINT OF VIEW: A MACRO MODEL FOR ESTIMATING THE MAGNITUDE OF SPACE RESEARCH BENEFITS FOR THE FEDERAL REPUBLIC OF GERMANY, PART 3A [UEBER DEN NUTZEN DER WELTRAUMFORSCHUNG AUS DEUTSCHER SICHT: EIN MAKROMODELL FUER DIE ABSCHAETZUNG DER GROESSENORDNUNG DES AUS DER WELTRAUMFORSCHUNG ABLEITBAREN NUTZENS FUER DIE BRD, TEIL 3A]
Heinz-Hermann Koelle, Gerd Ehinger, Frank Heidtmann, Fritz Lienemann, Goetz Niederau et al Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Jan. 1971 590 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-71-03) Avail: NTIS HC $6.00/MF $0.95; ZLDI Munich: 123.90 DM

A cost-benefit model for space programs of the German Federal Republic is described. The purpose of this model is to provide a decision aid for planning the German space program. The aim of this effort is to determine the benefit of space projects in their magnitude and trends. Furthermore the cost-benefit ratios of alternative space programs are investigated and the individual models for all areas of benefit are described. Author (ESRO)

N71-27106# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
RISK AND RISK CLASSIFICATION [RISIKO UND RISIKOKLASSIFIZIERUNG]
Hans Joerg Keller 4 Jun. 1969 13 p refs In GERMAN Presented at the DGLR Symp. on Reliability and Test Efforts, Munich, 12 Jun. 1969
(ZV-21-0) Avail: NTIS

The concept of risk is defined as the expectation value for a loss. Several factors influencing risk are discussed, and applications to easily manageable classification systems are described. ESRO

N71-27181# Gesellschaft fuer Weltraumforschung m.b.H., Bad Godesberg (West Germany).
PRODUCT QUALITY CONTROL IN THE GESELLSCHAFT FUER WELTRAUMFORSCHUNG [PRODUKTSICHERUNG IN DER GESELLSCHAFT FUER WELTRAUMFORSCHUNG]
9 Jun. 1969 8 p In GERMAN Presented at the DGLR Symp. on Reliability and Test Efforts, Munich, 12 Jun. 1969
Avail: NTIS

The planning of documentation and equipment specifications of the West German scientific satellite project is outlined. The methods of scheduling reviews over the different stages of the project in order to attain sufficient quality control are described. ESRO

N71-27206# Air Force Systems Command, Washington, D.C. Director of Labs.
AIR FORCE RESEARCH OBJECTIVES, 1971 Annual Report
ETHEL GAMER, ed. Mar. 1971 63 p refs
(AD-720905; DL-71-1) Avail: NTIS CSCL 5/1

The publication is intended to stimulate researchers in free-world colleges, universities, and nonprofit and industrial organizations to participate in the Air Force research program. By delineating the various facets of the four major divisions (Physical Sciences, Engineering Sciences, Environmental Sciences, and Life Sciences) of the Defense Research Sciences, and by describing in detail the specific fields where additional research is required, it is hoped to encourage outstanding members of the free-world scientific community to play a part in fulfilling Air Force research needs. Author (GRA)

N71-27267# Oak Ridge National Lab., Tenn.
ENVIRONMENTAL LAW ABSTRACTS, VOLUME 1
James W. Curlin, Roy W. Deitchman, and Gerald U. Ulrikson Feb. 1971 49 p refs Sponsored in part by NSF
(Contract W-7405-ENG-26)
(ORNL-NSF-EP-2-Vol-1) Avail: NTIS

A selective listing of articles on environmental policy and law is presented as an aid to the environmental scientist. It is the first in a planned series of annotated bibliographies to be drawn from current law literature. The topics cover natural resources, environment pollution, urban and regional planning, and transportation. A permuted key word index is provided. N.E.N.

N71-27296# United Kingdom Atomic Energy Authority, London (England).
REPORTS AND ACCOUNTS OF THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY FOR THE YEAR ENDED 31 MARCH 1970 TOGETHER WITH THE COMPTROLLER AND AUDITOR GENERAL'S REPORT ON THE ACCOUNTS

Annual Report, 1 Apr. 1969–31 Mar. 1970
22 Jul. 1970 118 p refs
(NP-18528) Avail: AEC Depository Libraries; HMSO 17s; RIS $3.50

The report is presented under the following headings: general survey, finance, accounts and contracts; trading fund report, production factories and the Radiochemical Center Amersham, the reactor program, nuclear fusion and plasma physics research, applied nuclear research and development, non-nuclear research and development, scientific and technical support, underlying research, major equipment, health and safety, international relations, information services, and the Authority's organization and staff. NSA

N71-27735*# Governmental Affairs Inst., Washington, D.C
THE ROLE OF THE REGIONAL DISSEMINATION CENTERS IN NASA's TECHNOLOGY UTILIZATION PROGRAM
John Geise NASA May 1971 111 p refs
(Contract NASw-2025)
(NASA-CR-1763) Avail: NTIS CSCL 05B

The objectives, operations, and accomplishments of NASA's Regional Dissemination Centers for technology transfer are discussed, with full documentation, and special attention to innovative procedures each has devised to bring the benefits of new aerospace technology to both private and public sectors of the national economy. NASA's entire technology utilization program is reviewed to place the RDC work in proper perspective and to illustrate the interrelationship between this work and the technology utilization program as a whole. In addition, recent historical developments related to technology transfer (e.g., the evolution of computers) are summarized to explain the basis of RDC operations. It is concluded that the RDC's play a significant and promising role in the technology utilization program, but that more time and further studies will be needed to fully evaluate their effectiveness. Specific suggestions are made concerning these further studies. Author

N71-27821# Weapons Research Establishment, Salisbury (Australia).
WEAPONS RESEARCH ESTABLISHMENT ANNUAL REPORT, 1969–1970
1971 56 p refs Original contains color illustrations
Avail: NTIS

Project and research activities, and test facilities and equipment are discussed. The ELDO vehicle launchings were ended and Black Arrow flights were begun. Brief reports are given on aerodynamic studies, rocket vehicle designs, weapon research, underwater sound detection, radio propagation, satellite tracking and communications, rocket sounding, atmospheric research, laminating press, down range telemetry receiving station, high powered mobile camera, and related topics. N.E.N.

N71-27868# Defense Documentation Center, Alexandria, Va.
DEVELOPMENT OF THE DEFENSE DOCUMENTATION CENTER REMOTE ON-LINE RETRIEVAL SYSTEM: PAST, PRESENT AND FUTURE
Richard K. Bennertz Mar. 1971 56 p refs
(AD-720900; DDC-TR-71-2) Avail: NTIS CSCL 5/2

The document highlights in nontechnical language the development of the DDC Remote On-Line Retrieval System from its inception in 1967 to what is planned. It describes in detail the current operating system, equipment configuration and associated costs, user training and system evaluation and may be of value to other installations embarking in an on-line development effort. Author (GRA)

N71-27883# National Bureau of Standards, Washington, D.C. Technical Analysis Div.
PROCEEDINGS OF JOINT MEETING OF GOVERNMENT OPERATIONS RESEARCH USERS AND PRODUCERS
Mary L. Friend, ed. May 1971 168 p Conf. held at Gaithersburg, Md., 5–6 Jun. 1969
(NBS-Sp-347) Avail: SOD $1.25

The Joint Meeting of Government Operations Research Users and Producers was organized to improve the communications among users of operations research within the government, and producers of operations research in public and private organizations. Government agencies were invited to report on exactly what they expect of their OR producers, what they expect to have done with the results, what the purposes and their uses of systems analysis are, and to give a general profile of their in-house work. Universities were invited to report on their capabilities and their desires and to discuss the OR projects currently in progress on their campuses. This meeting was the second in a planned series of meetings. It aimed at providing more responsive and more adequate studies for improving government agency management and productivity. Author

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DOMESTIC

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